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Том II



5-7 ноември 2026 г.

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# СЪДЪРЖАНИЕ

## ТОМ II
## МЕНИДЖМЪНТ, МАРКЕТИНГ, ПЛАНИРАНЕ, МЕЖДУНАРОДНА ИКОНОМИКА, БИЗНЕС ИНФОРМАТИКА


ИЗСЛЕДВАНЕ НА ГОТОВНОСТТА, НАГЛАСИТЕ И ПОТРЕБНОСТИТЕ НА ПРЕПОДАВАТЕЛИТЕ ОТ СТОПАНСКА АКАДЕМИЯ „Д. А. ЦЕНОВ“ ЗА ИЗПОЛЗВАНЕ НА ИЗКУСТВЕН ИНТЕЛЕКТ
**Проф. д.н. Борислав Борисов, гл. ас. д-р Юлиян Господинов**..... 9

THE PLACE AND ROLE OF UKRAINE IN ENSURING THE EU'S EXTERNAL ECONOMIC SECURITY
**Prof. D.Sc. (Economics) Illya Khadzhynov**..... 18

SHADOW DIGITAL ECONOMY AND SUSTAINABLE DEVELOPMENT
**Prof. DSC Serghei Ohrimenco, Prof. DSC Dinara Orlova, Prof. PhD Tatiana Manasterska, Valeriu Cernei, Partner, IT Audit&Advisory**..... 24

УПРАВЛЕНИЕТО НА ЗНАНИЕТО КАТО МЕХАНИЗЪМ ЗА ФОРМИРАНЕ НА ИНОВАЦИОННА СПОСОБНОСТ И ИНОВАЦИОННО ПРЕДСТАВЯНЕ НА ПРЕДПРИЯТИЕТО (ТЕОРЕТИЧЕН ПРЕГЛЕД И КОНЦЕПТУАЛНА РАМКА)
**Проф. д-р Любчо Варамезов, докторант Стела Маринова**..... 32

СТРАТЕГИЧЕСКАТА ДЪЛБОЧИНА (ВЪЗХОДЪТ) И НЕСТРАТЕГИЧЕСКАТА ПЛИТКОСТ (УПАДЪКЪТ) – КАЗУСЪТ НА СВИЩОВСКАТА АКАДЕМИЯ
**Проф. д-р Никола Янков**..... 40

LEAN MARKETING – СЪВРЕМЕНЕН ПОДХОД ЗА ТРАНСФОРМАЦИЯ НА МАРКЕТИНГОВАТА СТРАТЕГИЯ
**Доц. д-р Ваня Григорова**..... 48

ПОЗИЦИОНИРАНЕ НА ТЪРГОВСКА МАРКА В ДИГИТАЛНА СРЕДА
**Доц. д-р Ваня Григорова, Александра Иванова, студент**..... 56

СЪВРЕМЕННИ ПОДХОДИ ЗА ПРОДУКТОВА ИНОВАЦИЯ В КОЗМЕТИЧНИЯ СЕКТОР
**Доц. д-р Ваня Григорова, Марая Драганова, студент**..... 64

ДЕТЕРМИНАНТИ НА ТЪРСЕНЕТО НА ЗАСТРАХОВКИ СРЕЩУ ТЪРГОВСКИ РИСК
**Доц. д-р Ваня Григорова, докторант Николай Марков,**..... 71

ВЛИЯНИЕ НА ДИГИТАЛНИЯ БЪРНАУТ ВЪРХУ ПОТРЕБИТЕЛСКОТО ПОВЕДЕНИЕ
**Доц. д-р Ваня Григорова, Пламена Жекова, студент**..... 79

INTERNATIONAL ECONOMIC INTEGRATION AND STRUCTURAL RESILIENCE
**Assoc. Prof., PhD Giga Abuseridze, Assoc. Prof. PhD Anatoliy Asenov**..... 87

ПАРТИСИПАТИВНО ВЗАИМОДЕЙСТВИЕ В ИНОВАЦИОННИТЕ МРЕЖИ
**Доц. д-р Евелина Парашкевова, проф. д-р Маргарита Богданова, доц. д-р Александра Пенишевич, проф. д-р Бранислав Санчанин"** ..... 93

ОСОБЕНОСТИ НА СЪВРЕМЕННИЯ МЕЖДУНАРОДЕН БИЗНЕС
**Доц. д-р Здравко Любенов** ..... 101

CONVERGENCE OR DIVERGENCE? DIGITAL TRANSFORMATION AND EMERGING INTERNATIONAL MARKETING TRENDS IN ROMANIA AND BULGARIA
**Assoc. Prof. Cătălin Deatcu-Gavril PhD, assoc. Prof. Alexander Ganchev PhD, Ivaylo Marinov PhD, Vlad-Mihai Panait PhD, Ec. Elena Deatcu-Gavril** ..... 108

CYBERSECURITY AND OPERATIONAL RISK IN THE ERA OF DIGITAL TRANSFORMATION: CHALLENGES FOR SUSTAINABLE DEVELOPMENT
**Assoc. Prof. Habilitated Doctor Dorogaia Irina, Caminschi Olga, PhD student, Assistant Lecturer** ..... 122

MANAGING ORGANIZATIONAL STRUCTURE CHANGES IN AN UNSTABLE ENVIRONMENT
**Assoc. Prof. Habilitated Doctor Dorogaia Irina, Coval Anastasia, Assistant Lecturer** ..... 129

ДИГИТАЛНОТО РАВЕНСТВО КАТО ФАКТОР В ПРОЦЕСА НА ДИГИТАЛНА ТРАНСФОРМАЦИЯ
**Доц. д-р Кремена Маринова-Костова** ..... 139

ИНОВАЦИОННИ МРЕЖИ И МЕЖДУФИРМЕНО СЪТРУДНИЧЕСТВО: ФАКТОРИ, ВЗАИМОДЕЙСТВИЯ И РАЗВИТИЕ
**Доц. д-р Любомир Тодоров, проф. д-р Дариуш Новак** ..... 146

СОЦИАЛНОМРЕЖОВИ ПОДХОД ЗА ИЗСЛЕДВАНЕ НА МЕЖДУУНИВЕРСИТЕТСКОТО СЪТРУДНИЧЕСТВО В РАМКИТЕ НА ИНИЦИАТИВАТА „ЕВРОПЕЙСКИ УНИВЕРСИТЕТ“: СРАВНИТЕЛЕН АНАЛИЗ ПО ПОКАНИ ЗА КАНДИДАТСТВАНЕ
**Доц. д-р Маруся Смокова, гл. ас. д-р Галин Стефанов** ..... 155

ЕФЕКТИВНИ КОМУНИКАЦИОННИ СТРАТЕГИИ КАТО ФАКТОР ЗА ОРГАНИЗАЦИОННА УСТОЙЧИВОСТ
**Доц. д-р Милен Динков** ..... 166

ESG ПОЛИТИКИ И РЕШЕНИЯ В СТРОИТЕЛНИЯ СЕКТОР
**Доц. д-р Михаил Чиприянов** ..... 172

ВЪЗДЕЙСТВИЕ НА АГЕНТИТЕ С ИЗКУСТВЕН ИНТЕЛЕКТ ВЪРХУ СВЕТОВНАТА МРЕЖА
**Доц. д-р Наталия Маринова** ..... 176

ASSESSING FACTORS AFFECTING AN ORGANIZATION’S INFORMATION SECURITY
**Assoc. Prof. Olga Pugacheva, PhD** ..... 184

СТРАТЕГИЧЕСКИ АНАЛИЗ НА ПАЗАРА НА ЧУЖДОЕЗИКОВИ ОБРАЗОВАТЕЛНИ УСЛУГИ
**Доц. д-р Пенка Горанова**..... 192

ПРЕДИЗВИКАТЕЛСТВА И РИСКОВЕ ПРИ ВНЕДРЯВАНЕТО НА ИЗКУСТВЕН ИНТЕЛЕКТ И АНАЛИЗ НА ГОЛЕМИ ДАННИ ЗА УСТОЙЧИВИ ВЕРИГИ ЗА ДОСТАВКИ
**Доц. д-р Петя Емилова, доц. д-р Веселин Попов** ..... 198

MANAGING RESEARCH–EDUCATION SYNERGIES FOR ENGINEERING AND SCIENCE CAREER DEVELOPMENT IN THE UNIVERSITY ENVIRONMENT: THE CASE OF VALAHIA UNIVERSITY OF TÂRGOVIȘTE
**Assoc. Prof. Dr. Eng., Sălișteanu I.C., Professor, Dr. Eng., Dunea D.E.C. , Professor, Dr. Eng., Coandă H.G. , Assoc. Prof., Dr. Eng., Udroiu I.N. , Professor, Dr. Croitoru G., Senior Research Scientist, Dr. Eng., Nicolescu C.M., Assoc. Prof., Dr. Bumbac M., Assoc. Prof., Dr. Eng., Alexandrescu D.C., University Lecturer Dr., Hossu A.M., Assoc. Prof., Dr. Eng., Angelescu N., Assoc. Prof., Dr. Eng., Popa I.F., University Lecturer Dr., Catangiu A.** ..... 207

УПРАВЛЕНКСИ ИЗМЕРЕНИЯ НА КОНТИНУУМА „ПРОДУКТ – УСЛУГА“: ОПЕРАЦИОННА СИСТЕМА И ТРАНСФОРМАЦИОННИ ПРОЦЕСИ
**Доц. д-р Силвия Благоева, доц. д-р Ирена Емилова** ..... 217

АСПЕКТИ НА УПРАВЛЕНИЕТО НА КАЧЕСТВОТО В ОРГАНИЗАЦИИТЕ ОТ ПУБЛИЧНИЯ СЕКТОР
**Доц. д-р Христо Сирашки**..... 224

НАУЧНАТА ПОЛИТИКА НА СТРАНИТЕ ОТ ЕВРОПЕЙСКИЯ СЪЮЗ И ВЛИЯНИЕТО НА ГЛОБАЛИЗАЦИЯТА
**доц. д-р Цветан Дилков**..... 230

ВЗЕМАНЕ НА РЕШЕНИЯ ЗА ПОКУПКА В СРЕДА НА ИЗКУСТВЕН ИНТЕЛЕКТ
**Гл. ас. д-р Атанаска Решеткова**..... 238

ОСОБЕНОСТИ В АНТИКРИЗИСНОТО УПРАВЛЕНИЕ
**Гл. ас. д-р Валентин Панайотов** ..... 246

КОНВЕРГЕНЦИЯ НА ДОХОДИТЕ В РАМКИТЕ НА ЕВРОПЕЙСКИЯ СЪЮЗ: ДЕКОМПОЗИРАНЕ НА НАЦИОНАЛНО И РЕГИОНАЛНО НИВО
**Гл. ас. д-р Галин Стефанов**..... 253

АДМИНИСТРАТИВНИ РЕШЕНИЯ ЗА УСТОЙЧИВИ СОЦИАЛНИ ИНВЕСТИЦИ
**Гл. ас. д-р Десислава Алексиева**..... 262

ВАЛУТНА ЕКСПОЗИЦИЯ И ПОДХОДИ ЗА УПРАВЛЕНИЕ НА РИСКА: ИЗСЛЕДВАНЕ НА НАУЧНАТА ЛИТЕРАТУРА
**Гл. ас. д-р Димитър Костов** ..... 268

СТРАТЕГИЧЕСКИ АСПЕКТИ НА СВИВАЩИТЕ СЕ ГРАДОВЕ
**Гл. ас. д-р Елица Лазарова, Chrysostomos Roditis**..... 281

ГЕОПОЛИТИЧЕСКИЯТ РИСК КАТО ФАКТОР ПРИ ИЗБОРА НА ЛОКАЦИЯ ЗА ПРЕКИ ЧУЖДЕСТРАННИ ИНВЕСТИЦИИ
**Гл. ас. д-р Иван Ангелов** ..... 288

ПЕРИФЕРНИ ИЗЧИСЛЕНИЯ И ИНТЕРНЕТ НА НЕЩАТА: БЪДЕЩЕТО НА СВЪРЗАНИТЕ УСТРОЙСТВА
**Гл. ас. д-р Искрен Таиров** ..... 296

ЕВРИСТИЧНИ СТРАТЕГИИ ЗА РЕДУКЦИЯ НА СЛОЖНОСТТА В ИКОНОМИЧЕСКОТО ПЛАНИРАНЕ ПРИ ОГРАНИЧЕНА ИНФОРМАЦИЯ
**Гл. ас. д-р Надежда Веселинова** ..... 302

КАЧЕСТВО НА ТРУДОВИЯ ЖИВОТ: ОРГАНИЗАЦИОННО-ПОВЕДЕНЧЕСКИ АСПЕКТИ
**Гл. ас. д-р Надежда Стефанова** ..... 310

АНАЛИЗ НА ЕФЕКТИВНОСТТА НА ОНЛАЙН МАРКЕТИНГА И KPI ПОКАЗАТЕЛИ
**Гл. ас. д-р Пламен Петров** ..... 317

ТЕОРИЯ И ПРАКТИКА: ФАКТОРИ ЗА ИЗПОЛЗВАНЕ НА ИЗКУСТВЕН ИНТЕЛЕКТ ОТ СТУДЕНТИ ПО МАРКЕТИНГ
**Гл. ас. д-р Светла Атанасова** ..... 325

ДОБРИ ПРАКТИКИ ПО ПРЕДОСТАВЯНЕ НА ДОБРО УПРАВЛЕНИЕ ОТ ДЪРЖАВНАТА АДМИНИСТРАЦИЯ
**Гл. ас. д-р Юлиян Господинов** ..... 334

RETHINKING PLACE BRANDING: STRATEGIC FRAMEWORKS AND EXECUTION TOOLS
**Senior Lecturer, PhD, Aliya Turganovna Baigarina, PhD student Anar Aliyeva, Head Assist.Prof., PhD Stanislava Stoyanova-Asenova, Assoc.prof. PhD Anatoliy Asenov** ... 345

ЕЗИКОВА БЛИЗОСТ И ИНСТИТУЦИОНАЛНА ИНТЕГРАЦИЯ В МЕЖДУНАРОДНАТА ТЪРГОВИЯ: КОНЦЕПТУАЛЕН ПОДХОД
**Ст. преп. д-р Маргарита Михайлова, доц. д-р Драгомир Илиев** ..... 350

ОТ КОНЦЕПЦИЯТА ДО ВЪЗДЕЙСТВИЕТО: ДИЗАЙН И ИЗПЪЛНЕНИЕ НА УСПЕШНИ ПРОЕКТИ ПО ПРОГРАМА „ИНТЕРРЕГ РУМЪНИЯ–БЪЛГАРИЯ“
**Лектор, д-р Михаела Тинка Удриштиойу; професор, д-р Нику Джордже Биздоака** ..... 356

СТРАТЕГИЧЕСКО УПРАВЛЕНИЕ НА ЗАИНТЕРЕСОВАНИТЕ СТРАНИ ПРИ ПЛАНИРАНЕ НА ЕКОЛОГИЧНИ ПРОЕКТИ ЗА УПРАВЛЕНИЕ НА ОТПАДЪЦИ
**Ас. д-р Димчо Шопов** ..... 362

MANAGERIAL STRATEGIES FOR MOTIVATING THE EMPLOYEES FROM ROMANIAN PUBLIC INSTITUTIONS
**Assistant Professor, Ph.D, Miruna Angela Mutu, Senior Lecturer, Ph.D, Andreea Anamaria Panagoret, Senior Lecturer, Ph.D, Dragos Mihai Panagoret, Lecturer, Ph.D, Sorina Cernat** ..... 371

MAPPING AND MITIGATING CHILDREN'S DIGITAL FOOTPRINTS IN EGYPT
**Assistant Professor Nehal Lotfy H. Khalil, PhD**..... 384

ЕКСПЕРТНОТО ИНТЕРВЮ В ИЗСЛЕДВАНИЯТА ПО ДИГИТАЛЕН МАРКЕТИНГ: МЕТОДОЛОГИЧНИ НАСОКИ
**Ас. д-р Спасимир Цветанов**..... 392

МАРКЕТИНГ, ВОДЕН ОТ НОСТАЛГИЯТА В ЕРАТА НА ИЗКУСТВЕНИЯ ИНТЕЛЕКТ – ВЪЗМОЖНОСТИ, ПРЕДИЗВИКАТЕЛСТВА И ТЕНДЕНЦИИ
**Ас. д-р Стелиана Василева** ..... 400

AI В ПОМОЩ НА СЕЛЕКЦИОНЕРИТЕ В ЖИВОТНОВЪДСТВОТО: ПРОТОТИП НА ИНТЕЛИГЕНТНА СИСТЕМА ЗА АНАЛИЗ НА РОДОСЛОВИЯ И ПОДПОМАГАНЕ НА РАЗВЪДНАТА ДЕЙНОСТ
**Д-р инж. Пенка Чернаева, д-р инж. Петър Чернаев**..... 411

АНАЛИЗ НА ПОТЕНЦИАЛА НА ИНОВАЦИОННИТЕ ПРОЕКТИ ЗА НАМАЛЯВАНЕ НА БЕДНОСТТА В СЕВЕРОЗАПАДНИЯ РАЙОН ЗА ПЛАНИРАНЕ БЪЛГАРИЯ
**Д-р Таня Минкова Николова**..... 418

УЧАСТИЕТО В ИНИЦИАТИВАТА ЗА НАСОЧЕНА ТЪРГОВИЯ И ВИЗОВАТА ОТВОРЕНОСТ В АФРИКА
**Докторант Анита Йорданова** ..... 424

СТРАТЕГИЧЕСКО ПЛАНИРАНЕ НА РАБОТНАТА СИЛА В ЗДРАВНАТА СИСТЕМА НА ГЪРЦИЯ В КОНТЕКСТА НА ПРОФЕСИОНАЛНИТЕ ДИСБАЛАНСИ И РЕГИОНАЛНИТЕ НЕРАВЕНСТВА
**Докторант Анна Коллару** ..... 432

СТРАТЕГИЧЕСКО ПЛАНИРАНЕ И УПРАВЛЕНИЕ НА КРИЗИ В АДМИНИСТРИРАНЕТО НА ОБЩЕСТВЕНОТО ЗДРАВЕОПАЗВАНЕ
**Докторант Анна Коллару, докторант Алексиос Антониос Колларос**..... 439

МОДЕЛИ НА ПУБЛИЧНО-ЧАСТНО ПАРТНЬОРСТВО ЗА ФИНАНСИРАНЕ НА ОБЩИНСКАТА ТРАНСПОРТНА ИНФРАСТРУКТУРА
**Докторант Атанаска Василева** ..... 447

ИНТЕГРИРАН ПОДХОД ЗА ПОВИШАВАНЕ НА ЕФЕКТИВНОСТТА НА АДМИНИСТРАТИВНИТЕ ПРОЦЕСИ В ГЛОБАЛНИТЕ АУТСОРСИНГ СТРУКТУРИ
**Докторант Веселин Василев Михайлов**..... 451

СВЪРЗВАЩИТЕ СТРУКТУРИ В СИСТЕМАТА НА УПРАВЛЕНИЕ – МЯСТО И РОЛЯ
**Докторант Галина Гатева-Христова**..... 462

МЕЖДУНАРОДНА ТЪРГОВИЯ И ИКОНОМИЧЕСКИ БАРИЕРИ
**Докторант Георги Спасов Витков** ..... 467

ДЕТЕРМИНАНТИ НА КЛИЕНТСКАТА УДОВЛЕТВОРЕНОСТ В ЗАСТРАХОВАНЕТО – ПОВЕДЕНЧЕСКИ И ДИГИТАЛНИ АСПЕКТИ
**Докторант Десислава Кайрякова**..... 474

ПРЕДИЗВИКАТЕЛСТВА ПРИ ИНТЕГРАЦИЯТА НА НЕСТРУКТУРИРАНИ И ПОЛУСТРУКТУРИРАНИ ДАННИ ВЪВ ФИНАНСОВО-СЧЕТОВОДНИТЕ СИСТЕМИ
**Докторант Диян Николаев** ..... 482

WHO: TRANSFORMING ORGANIZATIONS THROUGH ESG CULTURE
**PhD student Elton Rodrigo Titon** ..... 488

ВРЪЗКА МЕЖДУ ИНТЕГРИРАНОТО УПРАВЛЕНИЕ НА ОТПАДЪЦИТЕ И КРЪГОВИТЕ БИЗНЕС МОДЕЛИ
**докторант Емил Найденов** ..... 496

ПРОГРАМНОТО БЮДЖЕТИРАНЕ КАТО ИНСТРУМЕНТ ЗА РЕАЛИЗАЦИЯ НА ОБЩИНСКИЯ ПЛАН ЗА РАЗВИТИЕ: МОДЕЛ ЗА ФИНАНСОВА УСТОЙЧИВОСТ
**Докторант Емилия Върбанова** ..... 504

ТРАНСФОРМАЦИЯ НА БИЗНЕС МОДЕЛИТЕ В СЕКТОРА НА ВЪЗОБНОВЯЕМАТА ЕНЕРГИЯ В ЕВРОПЕЙСКИЯ СЪЮЗ В УСЛОВИЯТА НА ЗЕЛЕНИЯ ПРЕХОД
**Докторант Жени Антонова** ..... 508

ИЗБОР МЕЖДУ ЛОКАЛЕН И ОБЛАЧНО БАЗИРАН ИЗКУСТВЕН ИНТЕЛЕКТ В СЪВРЕМЕННИТЕ БИЗНЕС ИНФОРМАЦИОННИ СИСТЕМИ
**Докторант Зорница Иванова** ..... 516

ОТ ТЕОРИЯ КЪМ ПРАКТИКА: ИНТЕГРИРАНЕ НА УСТОЙЧИВОСТТА В УПРАВЛЕНИЕТО НА ПРОЕКТИ КАТО ФАКТОР ЗА КОНКУРЕНТОСПОСОБНОСТ НА БЪЛГАРСКАТА ИКОНОМИКА
**Докторант Ивелина Станева** ..... 523

ВЪЗМОЖНОСТИ И ПРЕДИЗВИКАТЕЛСТВА ПРИ ИЗПОЛЗВАНЕТО НА ИЗКУСТВЕНИЯ ИНТЕЛЕКТ ЗА ОПТИМИЗАЦИЯ НА АДМИНИСТРАТИВНИТЕ ПРОЦЕСИ В ЗДРАВЕОПАЗВАНЕТО
**докторант Йоан Парашкевов Денев** ..... 528

ВЪЗМОЖНОСТИ И ПРЕДИЗВИКАТЕЛСТВА ПРЕД ВНЕДРЯВАНЕТО НА ИЗКУСТВЕН ИНТЕЛЕКТ В МАЛКИ И СРЕДНИ ПРЕДПРИЯТИЯ
**Докторант Йоанна Иванова Бакалова** ..... 536

ИНФОРМАЦИОННА СИГУРНОСТ В СЪВРЕМЕННИТЕ ОБУЧИТЕЛНИ ПЛАТФОРМИ
**Докторант Лора Първанова** ..... 551

ДЕФИНИРАНЕ НА БЛОКЧЕЙН: ХАРАКТЕРИСТИКИ И КЛЮЧОВИ КОМПОНЕНТИ
**Докторант Любен Кирев** ..... 551

ФАКТОРИ ЗА ВНЕДРЯВАНЕ НА ИНОВАЦИИ В ПУБЛИЧНИЯ СЕКТОР
**Докторант Мария Савова** ..... 557

УПРАВЛЕНИЕ НА НЕФИНАНСОВИЯ РИСК ЧРЕЗ КСО В БЪЛГАРИЯ
**Докторант Мария Цветанова** ..... 565

СРАВНИТЕЛНА ХАРАКТЕРИСТИКА НА МЕХАНИЗМИТЕ ЗА ВНЕДРЯВАНЕ НА КОМПЕТЕНТНОСТИ ПО ИКОНОМИКА
**Докторант Милена Димитрова**..... 569

СРАВНИТЕЛЕН АНАЛИЗ НА ДИГИТАЛНИ ПЛАТФОРМИ НА БЪЛГАРСКИЯ ПАЗАР ЧРЕЗ ИНДЕКС НА ПАЗАРНАТА ПРИВЛЕКАТЕЛНОСТ (MAS): NETFLIX, TRENDYOL И TEMU
**Докторант Невин Ангелова**..... 573

СТЕЙБЪЛКОЙНИТЕ В ТРАНСГРАНИЧНИТЕ РАЗПЛАЩАНИЯ: ПАЗАРНА КОНЦЕНТРАЦИЯ И РЕГУЛАТОРНИ ЕФЕКТИ ОТ MICA
**Докторант Пенко Ангелов Бяливанов**..... 580

ДЕТЕРМИНАНТИ НА КОРПОРАТИВНАТА СОЦИАЛНА ОТГОВОРНОСТ В МЕЖДУНАРОДНИ КОМПАНИИ ЗА БИЗНЕС УСЛУГИ
**Докторант Петьо Божинов**..... 588

КОНЦЕПТУАЛНА РАМКА НА ВНЕДРЯВАНЕТО НА ЗЕЛЕНИ ТЕХНОЛОГИИ В ПУБЛИЧНИЯ СЕКТОР
**Докторант Радослав Асенов**..... 596

УПРАВЛЕНСКИ ПРЕДИЗВИКАТЕЛСТВА ПРЕД ПУБЛИЧНИЯ СЕКТОР В УСЛОВИЯТА НА ДИГИТАЛНА ТРАНСФОРМАЦИЯ И ОТВОРЕНИ ИНОВАЦИИ
**Докторант Сание Иса**..... 604

TRANSFORMATIONAL LEADERSHIP AND AFFECTIVE ORGANIZATIONAL COMMITMENT: A FOCUSED NARRATIVE REVIEW
**PhD student Slagjana Cvetkovska Mousa**..... 611

ПРЕОДОЛЯВАНЕ НА ПРОПАСТТА В ЕКОЛОГИЧНИЯ ИНТЕГРИТЕТ: СРАВНИТЕЛЕН АНАЛИЗ НА РЕГУЛАТОРНАТА СТРОГОСТ НА СИСТЕМАТА ЗА ТЪРГОВИЯ С ЕМИСИИ НА ЕВРОПЕЙСКИЯ СЪЮЗ И ДОБРОВОЛНИТЕ ВЪГЛЕРОДНИ ПАЗАРИ
**Докторант Стефани Георгиева, Докторант, Антони Георгиев**..... 618

ВНЕДРЯВАНЕ НА ГЕНЕРАТИВЕН ИЗКУСТВЕН ИНТЕЛЕКТ И ИНТЕЛИГЕНТНИ АГЕНТИ В БИЗНЕС АНАЛИЗА: ТЕХНИЧЕСКИ ИЛИ ОРГАНИЗАЦИОНЕН ПРОБЛЕМ
**Докторант Таньо Георгиев Георгиев**..... 626

РЕШЕНИЯ ЗА ИНТЕЛИГЕНТНА МОБИЛНОСТ В СМАРТ ГРАДОВЕТЕ В БЪЛГАРИЯ
**Докторант инж. Тихомир Панов**..... 634

ГЕОГРАФСКА ЕКСПАНЗИЯ ЧРЕЗ МРЕЖОВИ СТРАТЕГИИ В СЕЛСКОСТОПАНСКАТА ТЪРГОВИЯ
**Докторант Тотю Иванов**..... 639

ПРИЛАГАНЕ НА АРХИТЕКТУРИ, УПРАВЛЯВАНИ ОТ СЪБИТИЯ, И МИКРОСЪРВИСИ ЗА ИНТЕЛИГЕНТНА АВТОМАТИЗАЦИЯ В ИНДУСТРИЯ 5.0
**Докторант Яница Димитрова**..... 643

ГЕНЕРАТИВНИЯТ ИЗКУСТВЕН ИНТЕЛЕКТ КАТО КАТАЛИЗАТОР НА ПЛАТФОРМЕНАТА ИНТЕРНАЦИОНАЛИЗАЦИЯ НА МАЛКИТЕ И СРЕДНИ ПРЕДПРИЯТИЯ
**Докторант Юксела Шефкетева Брахимбашева**..... 648

УЧИЛИЩЕТО КАТО СПЕЦИФИЧНА СРЕДА ЗА УПРАВЛЕНИЕ НА ПРОЕКТНАТА ДЕЙНОСТ
**Магистър Лора Николова** ..... 656

PSYCHOLOGICAL METHODS FOR MARKETING INFLUENCE ON CONSUMER BEHAVIOR
**Anna Grigorova, student** ..... 663

DIGITAL TRANSFORMATION AND CUSTOMER RELATIONSHIP MANAGEMENT IN SMES: A COMPARATIVE STUDY OF ROMANIA AND BULGARIA
**Student Elena Deatcu – Gavril, Student Adriana – Daniela Urucu, Student Diana – Marina Vasile, Student Angelo – Patrick – Cosmin Baicu**..... 670

СЪВРЕМЕННОТО ПРЕДПРИЯТИЕ В УСЛОВИЯ НА ГЛОБАЛИЗАЦИЯ И ДИГИТАЛИЗАЦИЯ
**Студент Милена Христова** ..... 679

# MAPPING AND MITIGATING CHILDREN'S DIGITAL FOOTPRINTS IN EGYPT

**Assistant Professor Nehal Lotfy H. Khalil, PhD**[1]

**Abstract:** *This paper synthesizes international literature and Egyptian evidence on children's digital footprints, integrating qualitative research and national reports. It identifies four trace sources–child, parent, peer, and platform—and proposes five-level mitigation across child, family, school, platform, and policy, shifting Egyptian digital safety from screen-time to an ecosystem perspective.*

**Keywords**: *digital footprints; datafication; digital privacy; sharenting; online safety; Egypt.*

**JEL:** L86, J13, O33, K24, I28

## 1. Introduction

Digital technologies are embedded in children's learning, communication, entertainment, peer interaction, identity expression, and family life. As these activities move online, information is recorded, copied, shared, inferred, and retained. A child's digital footprint therefore extends beyond material intentionally posted by the child and may include photographs and videos shared by parents, tags and screenshots created by peers, information collected by schools, and metadata or behavioral profiles generated by platforms. Contemporary research consequently treats children's digital lives as part of wider datafication rather than simply screen use (Hillman et al., 2024; UNICEF, 2024).

Egyptian evidence demonstrates substantial digital participation while revealing an important evidence gap. In the Egyptian Family Health Survey (EFHS) 2021, 45.3% of valid child records reported ever using the Internet and, among users, 73.1% reported using it almost every day. CAPMAS cautions that displayed case counts are not weighted population estimates. UNICEF's Situation Analysis of Children and Adolescents in Egypt 2024, drawing on EFHS and other national sources, estimated that 82.3% of youth in its analytic sample used the Internet at least once a week, with marked socioeconomic differences (CAPMAS, 2021; UNICEF Egypt, 2024).

Recent Egyptian studies show that online risks extend beyond time online. A 2024 study of high-school students in Zagazig examined cyberbullying and psychosocial factors, while a 2025 study examined cyberbullying involvement in relation to self-control, moral identity, gender, and socioeconomic conditions (Elsayed et al., 2024; Othman et al., 2025). A 2025 qualitative/KAP study of sharenting illustrates how parental practices can contribute to children's online identities and privacy exposure (Salem, 2025).

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Accordingly, this paper asks: (1) How are children's digital footprints generated? (2) What vulnerabilities are associated with these traces? (3) Which individual, family, school, and technological factors may protect children? and (4) What multilevel framework is supported by the combined evidence?

## 2. Review Approach

A structured systematic evidence review was undertaken to connect international evidence with Egyptian formal reports and empirical studies. Reporting was informed by PRISMA 2020 principles, particularly transparency in defining questions, information sources, eligibility criteria, evidence extraction, and synthesis (Page et al., 2021). Because the purpose was conceptual integration rather than estimation of a pooled effect, evidence was synthesized narratively and thematically rather than through meta-analysis.

The review focused primarily on literature published from 2021 to 2026, retaining earlier foundational work where necessary to define digital footprints, privacy, parental mediation, or children's digital rights. Searches used combinations of children, digital footprint, datafication, privacy, tracking, sharenting, parental mediation, online safety, cyberbullying, digital citizenship, and school data. International evidence was complemented by Egypt-specific searches and formal sources from CAPMAS, UNICEF Egypt, the Information and Decision Support Center (IDSC), and Egyptian research institutions.

Greater interpretive weight was given to recent systematic reviews, peer-reviewed empirical studies, official statistical datasets, and formal situation analyses. Local studies with narrow samples were treated as contextual rather than national prevalence estimates. Qualitative evidence was used to illuminate children's understanding of privacy, tracking, consent and control, and Egyptian family practices around sharenting. Formal sources were treated according to their function: surveys describe access and use; qualitative studies illuminate meanings and practices; and policy reports describe institutional responses and priorities.

## 3. Findings of the Evidence Synthesis

### *3.1. From Internet Use to Digital Footprints*

The evidence supports moving beyond how long children are online toward what traces are created through participation. Digital footprints include visible content, stored information, metadata, behavioral signals, and inferred characteristics. Platform registration, searches, recommendations, location services, advertising systems, and educational technologies can generate information associated with a child even without active posting (Crepax et al., 2022; Hillman et al., 2024). Thus, Internet-use intensity is an exposure indicator, not a complete measure of risk. A child spending substantial time on an educational platform may face different risks from a child using public social media, open gaming communities, or messaging services with unknown contacts. Conversely, limited activity can create highly sensitive information when it involves location, identifiable images, school information, or family narratives.

### *3.2. Four Sources of Digital Traces*

The synthesis supports a four-source model. (1) Child-generated traces include posts, photographs, videos, comments, profiles, gaming identities, and personal disclosures. (2) Parent-generated traces include photographs, achievements, school information, locations, and family narratives. (3) Peer-generated traces include tags, screenshots, photographs, reposts, comments, and group content. (4) Platform-generated traces include registration data, searches, engagement histories, recommendations, location information, advertising profiles, and behavioral metadata.

The parent-generated pathway is strongly supported by sharenting research. A systematic review of 61 empirical studies identified children's privacy, children's perspectives, factors affecting sharenting, and social-media dilemmas as major themes (Tosuntaş et al., 2024). A 2025 systematic review further found that sharenting is influenced by intrinsic motivations, social validation, and impression management, while children may object to sharing without consent (Motevalli et al., 2025). Parental sharing is therefore both a family practice and a mechanism of footprint formation.

Peer-generated traces reduce children's control because children may be represented in content they did not create and may have limited ability to prevent its circulation. Cyberbullying research similarly shows that digital harm can involve social, psychological, and privacy dimensions (Othman et al., 2025). Platform-generated traces are less visible but include tracking, behavioral data, profiling and data collection; child-specific privacy controls and data minimization remain important concerns (Crepax et al., 2022). Educational technologies can add engagement, participation and performance records that children may not recognize as part of their digital identities (Hillman et al., 2024; Ng et al., 2025).

### *3.3. Digital-Footprint Vulnerability*

Vulnerability is multidimensional and includes privacy disclosure, unwanted contact, cyberbullying, identity exposure, tracking, profiling, and loss of control. These outcomes differ in mechanism: disclosure may be intentional or involuntary; unwanted contact is associated with exposure to unknown users; cyberbullying is relational; tracking and profiling are often platform-mediated; and loss of control concerns the ability to understand, contest, remove, or limit information.

Egyptian evidence supports this multidimensional approach. The 2024 Zagazig study reported substantial cyberbullying victimization in its sample and examined Internet-use patterns alongside psychosocial correlates (Elsayed et al., 2024). Othman et al. (2025) examined cyberbullying involvement alongside self-control and moral identity, showing the relevance of individual and social factors. These studies are important local evidence but should not be interpreted as nationally representative prevalence estimates.

*3.4. Privacy Literacy, Digital Skills, and Protective Capacity*

Children may be competent technology users without fully understanding how data are collected, retained, copied, shared, or inferred. Research indicates that children distinguish interpersonal privacy from institutional and commercial data practices but may have difficulty connecting abstract tracking processes with everyday digital activity (Krüger et al., 2021; Gelman et al., 2024). Privacy literacy therefore differs from general digital skill.

Privacy literacy concerns personal information, consent, privacy settings, permanence, location privacy, tracking, and platform data practices. Protective behavior concerns actual actions such as limiting disclosure, configuring settings, blocking/reporting unsafe contacts, protecting accounts, and seeking help. This distinction highlights a potential knowledge–behavior gap: education may increase knowledge without changing behavior unless families, schools, and technologies provide supportive conditions.

*3.5. Parents, Schools, Platforms, and Policy*

Parents have a dual role: active mediation, rule setting, monitoring, communication, and technical controls can reduce risks, while sharenting can directly create children's digital traces. A systematic review found that positive parent–child relationships and family climates are generally associated with lower problematic social-media use, while Internet-specific mediation effects are more mixed (Vossen et al., 2024). Egyptian sharenting evidence similarly shows tension among affection, communication, social presentation, privacy, consent, and children's developing autonomy (Salem, 2025).

Schools are part of the data environment because educational platforms may collect attendance, engagement, performance, behavioral and interaction data. School preparedness should therefore include digital citizenship and privacy literacy education as well as responsible student-data governance, data minimization, consent-sensitive practices, reporting systems, and teacher competence (Hillman et al., 2024; Ng et al., 2025).

Platforms are active participants in children's digital environments because architecture influences collection, profiling, recommendations, and user control. UNICEF and the Committee on the Rights of the Child emphasize shared responsibility among children, families, educators, governments and businesses. Egyptian IDSC materials from 2024–2026 similarly identify child-focused connectivity, parental controls, age-appropriate content and regulatory mechanisms as emerging policy concerns (IDSC, 2024, 2026).

## 4. Integrative Interpretation

Across the evidence, digital-footprint vulnerability is not adequately explainned by Internet-use intensity alone. Exposure is the starting condition, while vulnerability depends on the type of digital participation, trace sources,

sensitivity and persistence of information, privacy literacy and protective behavior, and the protective environment provided by families, schools, platforms and policy.

The proposed model links digital participation to trace generation through four pathways—child, parent, peer and platform. Traces accumulate into a digital footprint; vulnerability emerges when the footprint creates opportunities for disclosure, unwanted contact, cyberbullying, identity exposure, tracking, profiling or loss of control. Protective capacity operates across this pathway and can buffer vulnerability. This explains why two children with similar Internet-use duration may experience different levels of risk.

The framework is ecological and socio-technical rather than individualistic. Children are developing agents who need privacy literacy and protective skills, but they cannot fully control parent-, peer-, or platform-generated information. The approach is consistent with children's rights principles emphasizing participation, privacy, protection and evolving capacities (Committee on the Rights of the Child, 2021; UNICEF, 2024).

## 5. Evidence-Informed Multilevel Framework

The framework has three connected pathways: an exposure pathway linking child characteristics and digital participation with trace generation; an actor pathway identifying the four trace sources; and a protection pathway identifying privacy literacy, privacy-protective behavior, parental mediation, family digital competence, and school preparedness. It is a theoretically informed framework rather than a deterministic causal model and requires empirical testing in Egypt.

*Table 1. Evidence-informed multilevel framework for children's digital footprints in Egypt.*

| Level | Evidence-supported mechanism | Priority response |
|---|---|---|
| Child | Participation creates intentional and unintentional traces; privacy knowledge may not translate into behavior. | Privacy literacy; protective behavior; consent; reporting and help-seeking. |
| Family | Parents mediate risk but also create traces through sharing. | Active mediation; responsible sharenting; family digital competence; child participation. |
| School | Educational participation creates institutional data; schools shape digital literacy. | Digital citizenship; student-data governance; teacher preparedness; reporting systems. |
| Platform | Registration, engagement, tracking, recommendations and profiling create less visible traces. | Privacy-by-design; data minimization; age-appropriate design; transparency and control. |
| Policy | Children's protection depends on standards and accountability beyond individual families. | Child-sensitive data governance; regulatory standards; cross-sector coordination; evidence-based monitoring. |

## 6. Egyptian Digital-Footprint Ecosystem and Research Implications

The framework is particularly relevant to Egypt because national evidence shows expanding digital participation alongside socioeconomic differences in access and use. UNICEF's 2024 situation analysis reports variation in Internet use by wealth and educational attainment, while CAPMAS provides child-level indicators of Internet exposure. Digital safety therefore cannot be separated from digital inequality. Children with different access levels may also differ in platform use, family support, privacy literacy opportunities, and exposure to protective resources.

Future Egyptian research should measure digital-footprint formation directly rather than using Internet-use duration as the principal exposure variable. A validated questionnaire should assess child-, parent-, peer-, and platform-generated traces together with vulnerability and protective capacity. Parent–child dyadic designs could identify discrepancies in reported use, sharing, mediation and risk. Qualitative research should examine children's meanings of privacy, consent, autonomy and control, as well as parental sharenting and school student-data practices.

## 7. Discussion

The principal contribution is to reframe children's digital footprints as an ecosystem produced by multiple actors. The framework separates digital participation from footprint formation, identifies four trace sources, distinguishes digital skill from privacy literacy, recognizes children's evolving autonomy, and distributes responsibility across child, family, school, platform and policy levels.

The Egyptian evidence strengthens the relevance of this approach: EFHS demonstrates substantial Internet participation; UNICEF shows socioeconomic differentiation; Egyptian empirical studies identify cyberbullying as a meaningful concern; sharenting research shows that family practices can contribute directly to children's online identities; and IDSC materials indicate growing governmental attention to child online protection. At the same time, national data on digital footprints remain less developed than data on access and use. Local studies often focus on individual risks rather than combined processes of data generation, privacy, tracking, profiling and loss of control. School and platform practices also require further empirical attention.

## 8. Limitations and Conclusion

The evidence base is heterogeneous in age, country, measurement and study design, preventing quantitative pooling. Some Egyptian studies are local or institution-specific and cannot be generalized nationally. Formal reports provide indicators and policy priorities but do not necessarily measure digital-footprint vulnerability directly. The proposed framework is evidence-informed rather than empirically validated and should therefore be tested with primary Egyptian data.

Children's digital footprints in Egypt should be understood as a multidimensional socio-technical phenomenon generated through children's participation and through parents, peers, schools and platforms. Vulnerability is not simply a function of time online; it emerges from interactions among exposure, participation, trace generation, risk characteristics and protective capacity. The framework integrates four trace sources with five mitigation levels. Privacy literacy and protective behavior remain essential but operate within parental mediation, family digital competence, school preparedness, child-sensitive platform design and policy governance. The principal implication is a shift from an Internet-use perspective toward a digital-footprint ecosystem perspective, providing a basis for developing and validating an Egyptian Digital Footprint and Online Safety Questionnaire and guiding future research and policy.

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