SMART CITY LUDWIGSBURG CASE STUDY PROJECT

Hochschule für Technik Stuttgart

CASE STUDY PROJECT SMART CITY LUDWIGSBURG

MASTER PROGRAM PROJECT

SEP 2018–JULY 2019 IN COOPERATION WITH THE CITY OF LUDWIGSBURG, GERMANY

CASE STUDY LECTURER DR. NADINE KUHLA VON BERGMANN PROF. ROLAND DIETERLE

INTERNATIONAL MASTER PROGRAM SMART CITY SOLUTIONS @HFT STUTTGART

IMAGES, FIGURES & ABBREVIATIONS PREFACE ACKNOWLEDGEMENTS

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ABBREVIATIONS

HfT	University of Applied Sciences Stuttgart
SCS	Smart City Solutions (Master Course)
SMAC	Sense.Map.Act.Co-create. (Teaching Methodol
ICT	Information and Communication Technoloav
AIT	Austrian Institute of Technology, Vienna

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PREFACE

» A GOOD CITY IS LIKE A GOOD PARTY – PEOPLE STAY LONGER THAN REALLY NECESSARY, BECAUSE THEY ARE ENJOYING THEMSELVES. « QUOTE BY JAN GEHL

This booklet documents the case study project that took place within two semesters, Wintersemester 2018 and Summersemester 2019 at the University of Applied Sciences HFT Stuttgart as part of the Master Program » Smart City Solutions (SCS) «. Thanks to a successful cooperation between the City of Ludwigsburg, plenty of guest lecturers and the international master students, the booklet proudly presents the methodology, the process and the outcomes of the Case Study project from the first generation of students participating in the SCS master program.

During the two semesters the students were guided under the methodological approach from Dr.-Ing. Nadine Kuhla von Bergmann, interim professor for » Smart Urbanism and Digital Strategies «, and the supervision of Prof. Roland Dieterle, the founder and head of the master program Smart City Solutions at HfT.

The urban planning approaches and infrastructure system knowledge gained in the various modules of the master course to create a diverse set of tailored smart solutions for the City of Ludwigsburg. Through the close cooperation with the municipality, the Innovation Network of Ludwigsburg and multiple civil society representatives, the students were faced with complex urban challenges. It was the aim of the Case Study project to address these challenges and to develop feasible urban development strategies, including the design of governance, finance and stakeholder management tools. The final deliverable was reached through the co-design of a bold vision for a dynamic and adaptive masterplan for the innercity.

During the project, several exchanges between the students and the municipality were organized, where students had the opportunity to present their findings and receive feedback. For instance, the design and co-creation of the visionary smart district development concept and implementation strategy for the innercity was done in a co-creation workshop with more than 30 different stakeholders. In the second semester, municipal department representatives served as mentors to give guidance in the implementation strategies.

The Case Study collaboration turned out to be benefitial for both parties, since the students developed and presented innovative approaches that enriched ongoing efforts from the city to become a smart, sustainable, inclusive and resilient city.





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The Case Study lecturers Dr. Nadine Kuhla von Bergmann and Prof. Roland Dieterle would like to express their gratitude for a successful cooperation and thank the following collaboration partners from Ludwigsburg for their great trust and support:

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IMG. 3 FIELD EXCURSION TO LUDWIGSBURG, OCTOBER 2018.



In Winter Semester 2018/19, HFT Stuttgart in Germany launched its new English-language Master's course » Smart City Solutions « – in its interdisciplinary approach unique in the world. In an international environment, students acquire comprehensive skills in the fields of smart city planning and buildings, smart infrastructure and city project management, as well as financing, digitalization strategies and smart governance.

More and more people around the world are moving to the conurbations in search of work, prosperity and a better standard of living. One result is urban sprawl – the uncontrolled expansion of city boundaries coupled with a significant increase of people's mobility. Cities around the world are suffering from noise pollution, congestion, gridlock, harmful air pollution and injust living conditions. Huge investment is required in social and technical infrastructure to take people in the direction of a livable urban future.

In addition, we are facing local and regional challenges and major global challenges: climate change, which requires effective and quick steps towards decarbonization; loss of biodiversity which demands to no longer accept » Anthropocene Cities « to be major disruptive factors within very sensitive biosphere systems.

In other words, following the understanding of the World Bank, a smart city should be described as a city that dramatically increase the pace at which it improves its sustainability and resilience, by fundamentally improving how it engages society, how it applies collaborative leadership methods, how it works across disciplines and city systems, and how it uses data and integrated technologies, in order to transform services and quality of life to those involved with the city (residents, businesses, visitors).

The » smart city « is an approach that is discussed intensively around the world – in Rio de Janeiro as in Mumbai, in Copenhagen as in Bangkok – and it is one that is yielding individal answers to similar questions. The Indian government, for example, has announced a program that will initially see 100 cities going » smart «. The process of forming appropriate consultancy teams for the task ahead, which is completely new in this form, is well underway around the world. We are still only beginning to prepare for this herculean challenge.

There are some promising signals and municipalities - as well as enterprises - realize and accept: there is no alternative than to actively and consequently breaking up into a sustainable future. Investors learn more and more that funding sustainable economy products, projects and enterprises is more profitable and less risky than investing into » old economy « opportunities.

» We need to equip the future generation with trans-disciplinary skills on personal, technical and methodological level to create sustainable and liveable cities. «

Prof. Roland Dieterle, January 2019

We will only meet the complex requirements of the livable, future-oriented city if we train on personal, technical and methodological levels, how to interact in a much more » transdisciplinary « way in the areas of transport, energy, urban development, public administration and finances. These areas have been rather poorly connected and their integration is key for resilient and smart cities. The fundamental work involves establishing the organisational structures and essential tools or databases that are vital for instigating change.

This is the point of departure for the smart city approach of the new master's course » Smart City Solutions «.

» THE PRACTICAL APPLICATION OF THE THEORETICAL MASTER COURSE KNOWLEDGE WAS A VERY BENEFICIAL ASPECT FOR THE STUDENTS (...) IT ALSO WAS OF VALUE TO THE MUNICIPALITY AS IT SHOWED THEM TO TAKE A HOLISTIC VIEW. (...) SO I THINK BOTH SIDES BENEFITTED FROM THIS CASE STUDY PROJECT. «

DR. ANDREA BRÄUNING Key Account Management Smart City, Region Europe, Robert Bosch GmbH

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IMG. 4 FIELD EXCURSION TO LUDWIGSBURG, OCTOBER 2018.





VON BERGMANN & MITCHELLE ROSALES **DR. NADINE KUHLA** ¥



SMART URBANISM AS NEW PARADIGM

The rapid global urbanisation, climate change and digitalisation trends are posing new challenges on existing and emerging cities and increasing the complexity of urban systems. This requires a radical change in planning and management approaches of cities to meet the Sustainable Development Goals Number 11: Sustainable Cities and Communities.Urbanism, the discipline that researches, designs and plans urban environments, has a big impact on economy, environment, society and the quality of life of all citizens. There is no other way but to include diverse civil agents, company representatives and municipal leaders at different stages of the design and implementation processes to put people's and communities' needs first.

In order to face current urban challenges, collaborative and holistic approaches are emerging (Eräranta and Staffans, 2015). These new practices support integrated planning and strive to practice an urbanism that includes multiple actors. In contrast to the smart city vision of global tech vendors, smart planning approaches take into consideration the spatial and social layer from cities and adopt transdisciplinary collaborative methodologies on base of ICT tools (Milojevic, 2018, Silva et al., 2018).

Smart Urbanism can be seen as device that responds to the three pillars of sustainability (social, economical & environmental) with specific focus on digital tools and spatial resources and solutions. It goes beyond interconnecting infrastructure with ICT technologies, its goal is to engage multiple stakeholders to improve the services offered by the city and to ensure a higher quality of life (Eggers and Skowron, 2018). The development and implementation of technology allows people to be connected in scales and ways that was not previously possible, therefore research of how contemporary problems can be solved with the collective intelligence that is triggered from this new possible connections (Malone, 2018).

Smart urbanism acknowledges the complexity and the interdependent systems of a city and adopts the multi-faceted user perspective as driving planning force. With this guiding principle, multi-coded spaces, connectivity and sensible use of natural resources is put at the heart of the design. The idea of smart urbanism is clearly linked with the vision to provide a better quality of life for all users by offering an adaptive toolkit of trans-disciplinary solutions that can act upon new challenges. As a result, smart urbanism adopts co-creation and collaborative practices as a key methodology and aims at building resilient adaptive urban systems.

FIG. 1 SCS STUDENTS: FERNANDES & SNDYAN (2018). SMART CITY SOLUTIONS TOOLKIT OF NEXUS PROJECT.



FIG. 2 KUHLA VON BERGMANN, ROSALES & SCS STUDENTS (2019). S.M.A.C. METHODOLOGY IMPLEMENTATION IN THE CONTEXT OF LUDWIGSBURG.

SMAC METHODOLOGY AS DIDACTIC TOOL

The SMAC was introduced by Dr. Kuhla von Bergmann as teaching methodology and set-by-step guide to carry out the Case Study module of SCS master program. The methodology was succesfully tested in urban design studios and summer schools before and evolves constantly. It supports the transition from a » top-down « planning approach towards a people-centred and data-based urban design which takes the complexity of urban systems into account. SMAC is designed to train analytical, design, communication and management skills and promotes the integration of expertise from various disciplines. The methodology can be applied as capacity building tool for both - students and cooperation partners - and stimulates living lab environments in cities.

SMAC is supporting the » smart urbanism « paradiam (see above) and aims at ellaborating a joint vision, quantifiable impacts, a dynamic masterplan and an agile action plan. It seeks to close knowledge gaps between experts and non-experts and ensures maximum exchange between decision-taking entities and citizens. SMAC support the design of solutions on the base of available local resources and cultures.

The SMAC process suggests four phases:

(1) SENSE: Analysis of existing urban, environmental, economic and social conditions. (2) MAP: Collection of social, economic, ecological, digital and spatial solutions. (3) ACT: Creation of vision and selection of smart solutions to meet the vision. (4) CO-CREATE: Co-design of dynamic masterplan with multiple stakeholders.

For the Case Study project 2019/2020, the methodology was applied in close collaboration with representatives from the City of Ludwigsburg, Baden-Württemberg, Germany. During this process, the municipality was involved in all steps of the methodology and citizens were involved in surveys and acted as co-creators of design strategies. SMAC bridged between grassroots initiatives and municipal staff and resulted in trust building and new partnerships.

Additionally, an online-based catalogue of solutions including nature-based and urban tech solutions was built and can be accessed and developed by future student generations.

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BY DR. NADINE KUHLA VON BERGMANN **METHODOLOGY** PROCESS CURATION . S.M.A.C

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APPLIED ON CASE STUDY MODULE OF SCS MASTER PROGRAM.



CO-CREATING COMPLEXI

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IMG. 5 CO-CREATION WORKSHOP AS PART OF CASE STUDY PROJECT IN COLLABORATION WITH THE CITY OF LUDWIGSBURG, CURATED BY DR. NADINE KUHLA VON BERGMANN, JANUARY 2019.

CO-CREATING COMPLEXITY

Co-creation methodologies have become an integral part of sustainable urban design projects. We are curently moving from selective moments of citizen participation towards longterm data-based decision-making processes of diverse interest groups. As this is relevant for all phases of an urban transition processes, new urban partnerships, innovative business models and horizontal governance structures are emerging. The vast data created during the concept, planning, implementation and operation phase of an urban development project reflects the complexity of knowledge management required.

The digitalisation of infrastructure services increases the complexity, however we are also given the chance to use digital tools to structure data in shared platforms and orchestre the access to knowledge for various stakeholders and decision makers. It requires neutral actors and trusted facilitators, e.g. digital officers or smart citizen boards, to develop digital strategies and concepts for integrated data platforms. These neutral » third parties « are responsible for ensuring data sovereignty and that digital strategies are of benefit to the majority of citizens. As the Case Study project showed, the success of a smart urban development projects will depend on facilitators and their management skills to deal with the complexity of capacities and societal demands.

» Climate change, waves of migration and digitalisation make urbanisation processes more complex. For this, we need creative processes, digital engagement tools and new partnerships. « Nadine Kuhla von Bergmann, January 2019

Besides mediating and knowledge exchange capacities, there is a need for new visualisation and communication tools to support co-creative design processes. It will be an ongoing challenge to produce a visual language expressed in plans, diagrams, metrics and interfaces to enhance a meaningful communication to co-produce urban futures.



ERL ш Δ AND ROL PROF. ø BERGMANN VON KUHLA NADINE DR. Ы



FIG. 4 SCS STUDENTS: KONRATZKI & FISCHER (2019). SMART & RESILIENT CITY STRAGIES FOR LUDWIGSBURG.

SMART CITY STRATEGIES & CASE STUDY PROJECT DELIVERABLES

The first semester aimed at the design and co-creation of a visionary evidence-based smart city development concept for the city of Ludwigsburg. The module was carried out as group exercise. The following deliverables were required:

- 1. Map existing urban and environmental conditions, infrastructural challenges, cultural realities, build assets, policy regulations, nature-based-sources, technological and socio-economic opportunities (deliverable: catalogue of structured and unstructured dat of local challenges & opportunities)
- 2. Foresee and communicate trends, demographic developments, innovation pathways and future urban challenges (deliverable: catalogue of global innovation & resilience strategies)
- 3. Scan the market to collect smart city solutions references (deliverable: inventory of smart city projects and solutions applied in various global contexts)
- 4. Develop smart city vision (deliverables: integrated innovative urban development plan, incl. system design, 3D vision & branding concept)
- 5. Explore database concept (deliverable: data platform concept)
- 6. Train curatorial skills to balance out interests of diverse players (deliverable: co-creation process design, workshops)
- 7. Design road map of smart city concept implementation including business models & governance strategies (deliverable: design of implementation & action plan)

The second semester focussed on the innercity district of Ludwigsburg. The projects and implementation plans responded to the key question: How is this area going to look like in 2030 with regard to fulfill the European Climate and Energy Framework targets and to the transition taking place triggered by e-commerce, new work culture and digitalisation. Deliverables included:

- 1. Midterm masterplan for selected innercity area in line with European Climate and **Energy Framework**
- 2. Detailed implementation and action plan for selected Innercity smart city district incl. proposal for intermeditate goals; KPI definition; identification of and proposals for suitable integrated pilot projects and their spatial requirements (public space design)
- 3. Engineering focus: particular technical focus on mobility solutions, resources & energy system solutions & concepts
- 4. Finance focus: development of business case(s) and business plans, combining public funding and private financial resources
- 5. Governance focus: administrative measures (human resources, policy design / legal requirements) stakeholder identification
- 6. Societal Focus: Welfare and equality aspects; social innovation strategies

» THE BEST OUTCOME OF THE CO-CREATION WORKSHOP WAS THE RAISE OF AWARENESS THAT WE NEED TO TRANSFORM THE CITY OF LUDWIGSBURG FROM SERVING CARS TO SERVING PEOPLE. (...) THAT HAD A VERY HIGH VALUE BECAUSE RIGHT NOW IT IS BASICALLY CAR MOBILITY DRIVEN. «

TINA MURPHY Citizen Activist, Radwegeinitiative Ludwigsburg

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IMG. 6 FIELD EXCURSION TO LUDWIGSBURG, OCTOBER 2018.

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IMG. 7 CO-CREATION WORKSHOP AS PART OF CASE STUDY PROJECT IN COLLABORATION WITH THE CITY OF LUDWIGSBURG, CURATED BY DR. NADINE KUHLA VON BERGMANN, JANUARY 2019.

CITY OF LUDWIGSBURG TOWARDS BECOMING A SMART AND RESILIENT CITY

The city of Ludwigsburg was founded in the 18th century and is a modern and highly traditional city in the region of Stuttgart, the northern part of one of the strongest economic German regions - (Ludwigsburg, 2019). Ludwigsburg is well-known for its international companies in the film and media industry, as well as its universities and wide range of educational opportunities (Ludwigsburg, 2019). The baroque market place and castles manifest the traditional side of the city and are of high interest to international tourists (ibid.) However, like many other middle-sized municipalities in Germany, Ludwigsburg is currently facing several urban challenges due to globalisation and demographic changes. It is responding to those challenges with integrated and comprehensive urban development strategies (Spec, 2018).

Which acute shocks, sudden and unforeseen events, or slow moving disasters might weaken the fabric of Ludwigsburg? And which resilience strategy could be applied? The global climate change impacts cause an increasing number of heavy rainfall events and river flooding, as well as an increasing number of more than 30 hot days per year. In fact, heatwaves are exemplary for acute and most probable shocks in Ludwigsburg (Ludwigsburg, 2018). Due to rising annual average temperatures, most of the rainfall occured shorter than long-term average (LUBW, 2019). Especially sealed areas suffer from missing urban vegetation to buffer and avoid urban heat island effects (Ludwigsburg, 2016).

Since the city is located in a prospering economic region, originated from the automotive industry, whose manufacturers are located in the region of Stuttgart, there is also a strongly rooted mindset towards the individual motorized transport. Due to 37,000 vehicles per day counted at the national highway B27 in 2014, the NO2 pollution levels are often above permissioned maximum levels (Stuttgart, 2019; LUBW, 2019).

Prospering regions and cities like Ludwigsburg are struggling with acute housing shortages (Ludwigsburg, 2018). The current population growth of 1,000 citizens per year, the low apartment fluctuation rate of less than three percent and decreasing number of completed apartments cause housing stress (Ludwigsburg, 2017; Ludwigsburg, 2018; WBL, 2017). Due to long approval procedures, building regulations or objections from neighbors, as well as steadily rising construction and land prices (increased of over 50% in the last decade) many projects are delayed or not realized at all (WBL, 2017). Additionally, the ageing population poses a challenge and illustrates the demographic shift.



There are nearly 20 percent 65 plus aged inhabitants in 2017 in comparison to formerly six percent in 1961 (Statistisches Landesamt Baden-Württemberg, 2019). With regards to retail, Ludwigsburg reaches a peak value of stationary trade in the region of Stuttgart and thus represents a popular shopping destination due to 80 percent higher income in comparison to German average (IHK, 2018; Binkowski, 2018). However, the city shows a development towards less owner-managed and long-established local businesses replaced by chain stores due to high rental prices (Axel Müller, 2018; IHK, 2017).

For a resilience strategy, numerous resources can be potentially identified and developed as » tools [that] help elevate and enhance the resilience value « of a city (100 Resilient Cities Network, 2019). Which customizable set of tools would improve Ludwigsburg's resilience capacity and set off suitable measures?

The industry sector, as most important resource for stability, is highly influenced by automotive suppliers and mechanical industry due to strong automotive sector in business region Stuttgart. Companies like Bosch, Porsche and Mann & Hummel represent three of the main economic drivers in the city. The related establishment of the » Living LaB «, the start-up incubator » grow « and mobility consultancy MHP are indicators for an innovation culture and regional impacts. International oriented companies are emerging and traditional businesses are widening their service portfolio towards consulting, smart homes, sensor techniques and technological driven living services. Consequently, local businesses of Ludwigsburg are currently forcing innovation and transition processes and the city itself benefits from the innovation network of business partners.

With regards to innovative partnerships, the » Living LaB « as link between municipality, citizens, businesses and research institutions, was founded in 2016 in order to enhance adaptations towards smart city progress by piloting projects under real-life conditions (Bietigheimer Zeitung, 2018). According to the Statistisches Landesamt Baden-Württemberg (2019), the city of Ludwigsburg is on the sixth place of the innovation index 2018 of the state Baden-Württemberg. Furthermore, the three universities and five academies located in Ludwigsburg are ensuring a high impact by the science and educational sector (Ludwigsburg, 2019). With nearly 10.000 students, 2% of population is described as youngsters who chose to move to the city for educational purposes (Statistisches Landesamt Baden-Württemberg, 2019). Potentially attracted by businesses and good living conditions, current students can be acknowledged as future innovation drivers and counteracting the trend of ageing population. Ludwigsburg's innovative potential was awarded with the » Digitale Zukunftskommune@ bw « label in 2018 and ranked under the first four digital driven municipalities in Baden-Württemberg (State of Baden-Württemberg, 2018).

IMG. 9 SMART URBAN PLANNING WORKSHOP. OCTOBER 2018. POR EVERY BOD LUDWIGSBURG MAPS RESERCH BAD GALOTTON Comparison Presentation Current Datos Demand Aualvied QUETONAIR /agornav STATUS QUO TRA FIC ANALYZES OFFREESINES / STATION (NOT FLEXIBLE) GOAL · INDIVIDUAL · SUSTAINABLE SHORT DISTANCES WIDEN USER VARIATY YORIENTATION 10 BICICLE SKTEM TOO EXPONDIVE | SUSI & NEILA

With regards to culture, heritage and related tourism, the urban environment is characterized by numerous events, buildings and an urban landscape that is related to baroque period (Ludwigsburg, 2019). The city is ranked as the fourth highest in overnight stays within region of Stuttgart (IHK, 2018). Various movie related institutions and universities, especially the » Filmakademie « and several entertainment related businesses are underlining Ludwigsburg's European and international role as entertainment and media innovation centre (SWR aktuell, 2018).

The river Neckar, is an important resource for climate resilience as its water flows trigger air circulation and provide natural air conditioning preventing urban heat islands (Kurier, 2018). Directly located at the natural river loops, Ludwigsburg benefits from a river biosphere that is maintained by regeneration projects to increase natural flora and fauna and to establish an ecological flood protection (Grünzug Ludwigsburg Neckar, 2019). Considering traffic infrastructure, Ludwigsburg is located centrally in the South of Germany and offers a convenient transport infrastructure for public and individual transport (Ludwigsburg, 2018; IHK, 2018). The bicycle network has been extended and covers 173 km and public transport services expand continously their offers, for example a 3 € daily ticket.

According to 100 Resilient Cities Network (100RC, 2019), city systems must be designed and functioning in a way that they can withstand, respond and adapt more quickly to its shocks and stresses in order to provide resilience. Hence, which of the identified measures recommended by the 100RC could be adopted by Ludwigsburg? Sealed surfaces in highly dense areas could be unsealed and exchanged by green areas for natural drainage and air compensation in order to decrease the impact of urban heat islands. A beneficial side effect is the creation of leisure areas for the community. It is advised to attract and educate people to the usage of public transport and alternative mobility like bikes and cargo-bikes, electric scooters or shared mobility. This impacts on decarbonization and would promote car-free zones while simultaneously expanding and giving privilege to cycle path network as well as providing mobility hubs where modes of transports can be switched. An implementation of a benefit system where people will be rewarded if they use alternative transport is recommended as further measure. By giving incentives and triggering experiential learning, a wider support for minimising motorised traffic services

For responding to the more intertwined stresses like ageing population, housing shortage and decreasing commerce, a comprehensive strategy needs to be developed. By reactivating vacant buildings and brownfields and the promotion of hybrid spaces, where multigenerational housing and community spaces are offered, an adaptive capacity for

is expected.

zurück zur Seite Luft & Lärm

SAUBERE LUFT FÜR LUDWIGSBURG

GEMEINSAM GEGEN FAHRVERBOTE

Ludwigsburg bietet echte Alternativen zum Auto und zur herkömmlichen Mobilität

NACHHALTIGE MOBILITÄT IN LUDWIGSBURG

Ziel der Stadt Ludwigsburg ist ein nachhaltiger, intelligenter und effizienter Verkehr, der das mobile Leben der Bürgerinnen und Bürger bereichert und die Umwelt schützt. Fahrverbote sind kein geeignetes Mittel: Um diese abzuwenden, will Ludwigsburg bereits nächstes Jahr durch technologischen Vorsprung den gesetzlich vorgeschriebenen Grenzwert für Stückstoffdioxid erreichen. Mit den Maßnahmen im 2018 erarbeiteten Green City Masterplan wird dies gelingen. Das bestätigt auch das Regierungspräsidium Stuttgart in seinem aktuellen Luftreinhalteplan.

Nachhaltige Mobilität in Ludwigsburg bedeutet:

Ausbau des öffentlichen Personennahverkehrs (ÖPNV)

Digitalisierung der Verkehrsleittechnik

Förderung der Elektromobilität

Ausbau der Radinfrastruktur

KONTAKT

Fachbereich Nachhaltige Mobilität Stadt Ludwigsburg Zentrale Mail-Adresse: <u>mobilitaet@ludwigsburg.de</u>

DOWNLOAD

Luftreinhalteplan Entwurf 2019 Schlussbericht "Green City Masterplan" komplett als PDF Kurzfassung zum Schlussbericht "Green City Masterplan" future uses and unforeseen societal needs is given. Digital and analog systems for neighborly assistance combined with flexible retail and co-working areas could balance out rental costs and start-ups and attract local business founders and suppliers.

By increasing the user experience of the central inner-city common areas through nature-based-solutions, raise in attractivity for tourists and a higher commercial turnover is expected. Simultaneously this would provide more incentives for youngsters to stay after their studies. Private owners and businesses could be activated through tax incentives. These resources need to become part of action plans and measures to reduce ongoing stresses and shocks and they need to be monitored continuously to evaluate the impacts of the approaches.Short term measures such as decarbonization zones sourced by prohibited traffic, could be realized easily if municipal and political support exists. In contrast to that, affordable housing or lack of space cannot be improved by any mentioned resource in a shortterm view. Consequently, it is necessary to cluster measures into long-term and short-term impact approaches to provide an effective resilience strategy for the city of Ludwigsburg.

In summary, Ludwigsburg is already faced by several stresses and shocks, such as ageing population, decreasing commercial activities or air pollution and congestion of traffic. However, statistical data shows that the innovation index, general business growth and the total number of students developed positively. All aspects play an important role to create potential buffers and capacities for facing future challenges and progress towards a resilient city.

IMG. 10 LUDWIGSBURG (2019). WEBSITE OF LUDWIGSBURG: ENERGY, ENVIRONMENT AND TRAFFIC.

SMART SUSTAINABLE CITY AMBITIONS

The city of Ludwigsburg has been developing strategic sustainable urban development goals alongside with its citizens since 2005. Various conferences were set up under the name of » Zukunftskonferenz « (Future Conference) with the goal to translate the outcomes into a widely accepted and integrated planning approach as tool to ensure sustainability of the city (Spec, 2018). In these conferences, citizens are able to participate, engage and express their ideas towards goals and relevant projects for the city (ibid).

As outcome, an integrated concept for the future development of the city was published under the name of » Chancen für Ludwigsburg « (chances for Ludwgigsburg). The concept covers eleven goals: green in the city, energy, mobility, economy and employment, education and childcare, digitalization, lively urban districts, cultural living, vibrant downtown, cohabitation of generations and culture, sport and health and attractive living (Zuko, 2018). Ludwigsburg succesfully follows the slogan: » If the world becomes more complex, more heads need to come together to find solutions « (» Wenn die Welt komplexer wird, müssen mehrere Köpfe denken «) (ibid).

FIG. 6 SCS STUDENTS: SHAIKH & KONRATZKI (2019). LUDWIGSBURG DEVELOPMENT GOALS. IMG. 11 FINAL PRESENTATION OF THE FIRST SEMESTER OF SCS STUDENTS, IN COLLABORATION WITH LUDWIGSBURG. DIPL. WERNER SPEC, FORMER MAYOR OF LUDWIGSBURG.

CHALLENGES AND OPPORTUNITIES

The inner-city of Ludwigsburg is characterized by touristic and commercial activities. The rise of e-commerce puts an enormous pressure on shop owners and commercial centers. This shift in economic activities is impacting on turn-over and on the use of the city center. Diminishing occupancy of shops, a shifting ownership, derelict buildings, increasing pollution and missing public services are the reason for a loss in attractiveness of public life. There is an urgent need to co-design a new vision and concrete measures to ensure a vibrant housing and working inner-city district – for locals as well as visitors. A dynamic master plan which can respond to future unexpected transitions. The masterplan should be composed of innovative mobility and logistic services, hybrid use buildings, blue-green solutions, social innovations and new cooperation and business models to ensure a resilient and diverse city centre.

FIG. 7 SCS STUDENTS: SHAIKH, BISIGNANI (2019). SWOT ANALYSIS FOR THE CITY OF LUDWIGSBURG. IMG. 12 FIELD EXCURSION TO LUDWIGSBURG. OCTOBER 2018.

» I THINK IT WAS GOOD FOR THE STU-DENTS TO UNDERSTAND THE PROBLEMS AND BE CONFRONTED WITH DIFFERENT INTERESTS AND OPINIONS. (...) THE MUNICIPALITY GOT SOME FRESH IDEAS, SOME NEW INPUTS AND A LOT OF INSPIRATIONS.

I ALSO BELIEVE THAT THE STUDY PROJECT HELPED THE CITY TO GET FRESH INPUTS AND INSPIRATION AND IT PUSHED SOME-HOW THE INNER PROCESSES AND THEIR DISCUSSION CULTURE. «

CATHRIN KRUMREY Head of Stuttgart Office, SBA Architektur und Städtebau

IMG. 13 SCS RESILIENCE WORKSHOP, CURATED BY DR.-ING. NADINE KUHLA VON BERGMANN & DIPL.-ING. NICOLE BARON, JUNE 2019.

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CHAPTER III MAKING-OF

IMG. 14 EXCURSION TO ASPERN CITY IN VIENNA, MAY 2019. IMG. 15 EXCURSION TO THE INTELLIGENT CITY LAB AT THE AIT IN VIENNA, MAY 2019. IMG. 16 EXCURSION TO MÖCKERNKIEZ IN BERLIN, NOVEMBER 2018.

IMG. 23 EXCURSION TO SMART CITY EXPO WORLD CONGRESS IN BARCELONA, NOVEMBER 2018. IMG. 24 EXCURSION TO SMART COUNTRY CONVENTION IN BERLIN, NOVEMBER 2018. IMG. 25–26 EXCURSION SMARTER TOGETHER PROJECT IN VIENNA, MAY 2019. IMG. 27–28 EXCURSION TO THE INTELLIGENCE CITY LAB AT AIT IN VIENNA, MAY 2019.

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IMG. 29–31 SCS MASTER PROGRAM WORKSHOPS.

IMG.32–36 SCS MASTER PROGRAM WORKSHOPS. IMG. 37 FRIDAYS FOR FUTURE WORKSHOP AS PART OF CASE STUDY MODULE, MARCH 2019.

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IMG. 38 CASE STUDY DESIGN SESSION, JUNE 2019. IMG. 39–40 PREPARATION OF CO-CREATION WORKSHOP, JANUARY 2019.

IMG. 45–47 CO-CREATION WORKSHOP AS PART OF THE CASE STUDY PROJECT IN COLLABORATION WITH THE CITY OF LUDWIGSBURG, CURATED BY DR. NADINE KUHLA VON BERGMANN, JANUARY 2019.

IMG. 48–53 CO-CREATION WORKSHOP AS PART OF THE CASE STUDY PROJECT IN COLLABORATION WITH THE CITY OF LUDWIGSBURG, CURATED BY DR. NADINE KUHLA VON BERGMANN, JANUARY 2019.

IMG. 54–58 CO-CREATION WORKSHOP AS PART OF THE CASE STUDY PROJECT IN COLLABORATION WITH THE CITY OF LUDWIGSBURG, CURATED BY DR. NADINE KUHLA VON BERGMANN, JANUARY 2019.

» THE MAIN BENEFIT OF THIS COLLABORATI-ON BETWEEN THE CITY OF LUDWIGSBURG AND THE SCS MASTER PROGRAM WAS THE CREATIVE AND THE UNCONVENTIONAL IDEAS CREATED BY THE STUDENT GROUPS (...) IT'S ALWAYS IMPORTANT TO HAVE A VIEW BEYOND THE HORIZON.

THE CO-CREATION WORKSHOP PUSHED THE CONNECTION AND INFORMATION EXCHANGE BETWEEN DIFFERENT CITY DEPARTMENTS ABOUT CURRENT PROJECTS. «

CHARLOTTE KLOSE Deputy Director of Climate Change Adaptation, Climate, Energy and European Affairs, City of Ludwigsburg

CHAPTER IV MASTER STUDENT PROJECTS

IMG. 59 SCS STUDENT FISCHER (2019). SMART CITY VISION FOR LUDWIGSBURG.

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PROJECTS

NEXUS

STUDENT THE NEXL

THE NEXUS | PROJECT DESCRIPTION

The nexus is a series of interconnected networks in space and time. » The Nexus Ludwigsburg « is a project that aimed to provide a network of sustainable solutions for a resilient future for Ludwigsburg. The one-year long study began with the identification and design of six synergy spots in the city, each with a unique context and actor constellation. The project at that stage, aimed to engage different kinds of neighbourhoods and citizens in a citywide development program. The solutions were designed with the factor of urban nature incorporated in each solution. Public space, residential neighbourhoods, commercial areas or even mobility hubs, were not seen only as mono-functional entities. They were instead analyzed from social, economic, ecological and digital perspectives. The primary focus of the solutions designed by the Nexus, however, was the incorporation of nature and natural processes within the inter-connected systems like water, energy and green areas of the city. In the second stage, the solutions were condensed and then adapted to suit the requirements of the heart of the city, the ZIEL area. A public space with immense potential, had to be a beacon not only for social and cultural life, but for a clean and sustainable future. Collaborative practice in urban farming, the transition to higher quotients of permeable land in the city centre and an innovation laboratory are some of the examples through which the Nexus wished to manifest its goals in the ZIEL area.

FIG. 8 SCS STUDENTS: FERNANDES AND SNDYAN (2018) SPATIAL ANALYSIS OF LUDWIGSBURG.

78 18 A 18 PROJECTS NEXUS STUDENT THE NEXL

FIG. 9 SCS STUDENTS: FERNANDES & SNDYAN (2018). GUIDING PRINCIPLES OF THE PROJECT » THE NEXUS «

81

FIG. 10 SCS STUDENTS: FERNANDES & SNDYAN (2018). FIRST VISION FOR CITY OF LUDWIGSBURG.

PROJECTS THE NEXUS STUDENT

D

FIG. 11 SCS STUDENTS: FERNANDES & SNDYAN (2019).SMART SOLUTION DETAILS.

STUDENT PROJECTS: LU.DWIGSBURG

IDENTITY

LU.DWIGSBURG | PROJECT DESCRIPTION

The main goal of the project is to help Ludwigsburg to connect economic growth with alternative mobility services using the city's cultural identity and technology companies as the main asset. Since the world is changing through technology, connectivity and individuality as main drivers to create prosperous cities.

To make Ludwigsburg a smarter and more sustainable city, a Living Lab environment is suggested for the inner-city to enhance innovation and entrepreneurship while focusing on social benefits. The project identified and studied areas of opportunities for alternative mobility services to support innovative businesses achieving decarbonization of the city. A new integrated street festival experience is proposed, where activities for different generations and audiences are offered. In this seasonal public space experience, various interest groups are attracted through tactical urbanism and creating opportunities for new partnerships.

The five main guiding principles that were developed are: new business, alternative mobility, accessibility, identity and attractiveness for young people. Sustainability is the core of this project, since the main strategies will support environmental friendly solutions and services tailored with a human centred approach.

FIG. 12 SCS STUDENTS: FISCHER, KONRATZKI, RAVI & ROSALES (2018 GUIDING PRINCIPLES OF PROJECT » LU.DWIGSBURG «

ALTERNATIVE

MOBILITY

ACCESSIBILITY

6. 14

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86

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STUDENT PROJECTS LU.DWIGSBURG

FIG. 13 SCS STUDENTS: FISCHER, KONRATZKI, RAVI & ROSALES (2018). SPATIAL ANALYSIS IN RELATION OF COMMERCE , TOURISM, RETAIL AND MOBILITY.

L**U.**dwigsburg App

FIG. 14 SCS STUDENTS: FISCHER, KONRATZKI, RAVI & ROSALES (2018) VISION FOR CITY OF LUDWIGSBURG WITH INTEGRATION OF SOLUTIONS.

Pop up stores

McDonald's

and reduce usage and run on renewable energy FIG 15 SCS STUDENTS: FISCHER, KONRATZKI, RAVI & ROSALES (2018) VISION FOR CITY OF LUDWIGSBURG OF WILHELM STRASSE EVENT. Water efficient, waterless or grey water systems that dispose waste water correctly Free alternative mobility Provide drinking fountains incentives to get people, to reduce water bottles Using alternative mobility Collection of data performance and Energy efficiency, environmental Free alternative mobility transformation of activities Digital + Analogue incentives to get people, to energy Using alternative mobility mun A A A A A A

Recycling Reusable Upcycle Organic waste

Saving generators, monitor

Possibility of Tram in the Street to create accessibility

Cargo bike implementation Decarbonized logistics system

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HEALTHY ORIENTATION | PROJECT DESCRIPTION

This project aims towards the creation of safe, secure and green environment in the city of Ludwigsburg and to improve the quality of life by orienting people towards a healthier lifestyle.

The project also aims at promoting eco-friendly and sustainable urban environments by orienting people more towards physical activities. User-friendly attractive non-motorised transport (NMT) is suggested and will help to reverse the trend towards use of private vehicles. The design vision suggests development of green areas and sport facilities in the inner city to make the city of Ludwigsburg smarter and healthier.

NMT is often a key element of successfully encouraging clean urban transport. Combined with digital platform mobility services, it is a very convenient mode of transport for relatively short distances. The climate mitigation impact will be large as it makes up the largest share of trips in the city.

Walking and cycling are made more attractive through a range of design solutions including construction of sidewalks and bike lanes, but also business models such as bike sharing programs. This will be implemented on base of an integrated urban planning and pedestrian-oriented development concept co-designed by experts, citizens, companies and the municipality.

This proposal anticipates to be of environmental benefit and will also improve the air quality and reduce energy consumption. It is expected that people will save time and costs while using mobility infrastructure and attractive well-connected environment. Offering green and safe common spaces and meeting points, positive user experience will be created.

FIG. 16 SCS STUDENTS: YALAZ, JAYAWANT, FUENTES & SHAIKH (2018). SPATIAL ANALYSIS OF LUDWIGSBURG IN RELATION TO MOBILITY AND ORIENTATION.

STUDENT PROJECTS: HEALTHY ORIENTATION

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FIG. 17 SCS STUDENTS: YALAZ, JAYAWANT, FUENTES & SHAIKH (2018). VISION FOR CITY OF LUDWIGSBURG AND TOOLKIT RECOMMENDATIONS.

ZIEL PLUS VISION

For achieving an appropriate level of decarbonization and reduction of air pollution, two overarching measures have been defined. On one hand, a good orientation system is aiming for a pedestrian-friendly city and on the other hand, an integrated system for attractive alternative mobility such as (e-)biking, cargo bikes and public transport to overcome the so-called » last mile « shall contribute to a healthy and inclusive community. The creation of dynamic and flexible public spaces will significantly enhance the user experience. This will be achieved by a variety of facilities such as pop-up stores and tactical urbanism as well as sports events, in combination with hybrid building uses, which on one hand contribute to the education of people on various sustainability issues and on the other hand to a healthy economy through the provision of affordable communal spaces. The integration of digitally supported tools will help to monitor the KPI's for the above objectives, e.g. by measuring the degree of decarbonization over time by IOT-based sensors. At the same time, such instruments will contribute to municipal decision-making processes by enabling a convenient participation process for each individual.

The overall vision for the future of Ludwigsburg is thus characterized by a resilient and self-sustaining infrastructure and community, a good orientation system and a broad range of mobility options, nature-based-solutions and a high degree of user experience and dynamic uses.

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SBURG UDIW ERPL Ч Ч ЧO AM DYNAMIC \cup INNER

FIG. 20 SCS STUDENTS: KONRATZKI & FISCHER (2019). RESILIENCE DIAGRAM APPLIED TO LUDWIGSBURG.

FIG. 21 SCS STUDENT FERNANDES (2019). PROCESS DESIGN DIAGRAM.

LUDIWGSBURG ERPLAN 106 MASTI Ц О \succ INNER CIT DYNAMIC

108

LUDIWGSBURG DYNAMIC MASTERPLAN ЦО INNER CIT

FIG. 23 SCS STUDENTS: RAVI & ROSALES (2019). VISION OF TOOLKIT IMPLEMENTATION FOR THE ZIEL AREA.

GSBURG AN 110 LUDIW ERPL S ЦO ∢ Ś DYNAMIC INNER CIT

AN PLUSDYNAMIC MASTERPL OF LUDIWGSBURG CITY INNER ZIEL

112

FIG 25 SCS STUDENT SNDYAN (2019). SECTION OF VISION FOR ZIEL AREA WITH INTEGRATION OF SOLUTIONS.

Z ERPL OF LUDIWGSBURG ST AA **PLUSDYNAMIC** CITY INNER ZIEL

114

LUDIWGSBURG AN ERPL ST ЦО \triangleleft Ś DYNAMIC INNER CIT

116

FIG. 27 SCS STUDENTS ROSALES (2019). DIGITAL SERVICES IN APPLICATION OF ZIEL AREA.

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 1.3 CD Societal Developments/ Challenges Dr.nat.rer. Stefan Carsten 1.5 CP / 1.5 w.p.s. 	2.3 SSI Smart Social Infrastructure & Accommodation Dr. Ing. Florian Wiedmann 1.5 CP / 1.5 w.p.s.	3.3 SET Smart Engineering & Technologies Dr. Tobios Erhart Dr. Dilay Kesten Erhart 1.5 CP / 1.5 w.p.s.	 4.3 CIM City Information Model Dipl. Ing. Carsten Rönsdorf 1.5 CP / 1.5 w.p.s.
1.4 SPM Smart City Parameters & Measuring Prof. Roland Dieterle Dr. Andrea Bräuning 1.5 CP / 1.5 w.p.s.	2.4 STP Smart Town Planning; Land Policy Dr. Nadine Kuhla v. Bergmann Carolin Dieterle 1.5 CP / 1.5 w.p.s.	3.4 BIM Planning & Building Processes (incl. BIM, Certification etc) MArch Dipl.Ing.Thomas Kraubitz 1.5 CP / 1.5 w.p.s.	4.4 DPS Digital Platforms & Services Dr. Nadine Kuhla v. Bergmann DiplKfm. Thorsten Milsmann 1.5 CP / 1.5 w.p.s.

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LU 9.1 / CS 1 CASE STUDY 1 FOCUS: URBANISM, BUILDING & INFORMATION AP: M1 - Prof. R. Dieterle, M2 - Dr. N. Kuhla v. Bergmann, M3 - Dipl. Ing. C. Krumrey , M4 - Dr. S. Seelig

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5.2 SGS* Smart Grid Solutions D: Ing. Tobias Weißbach 1.5 CP / 1.5 w.p.s.	6.2 PPR Pollution Prevention & Recovery Strategies (Air, Soil, Water) Dr. Marius Mohr 1.5 CP / 1.5 w.p.s.	7.2 SFI Sustainable Finance Pat. Dr. Tobias Popovic 1.5 CP / 1.5 w.p.s.	8.2 PS Public Se Manager Prof. Dr. 1.5 CP
5.3 SMM* Smart Mobility Strategies & Management Dr. Barbaro Fligge / Prof. Dr. Lutz Gaspers 1.5 CP / 1.5 w.p.s.	6.3 SUB Smart Urban Biosphere & Habitat (incl. Nutrition) Prof. Dr. Jürgen Breuste 1.5 CP / 1.5 w.p.s.	7.3 IPF Infrostructure & Project Finance NN 1.5 CP / 1.5 w.p.s.	8.3 LA Lean & A Approact Prof. Rol 1.5 CF
5.4 SEM Smart Operations & Maintenance Prof. DrIng. Axel Norkauer / DiplIng. Johannes Winter 1.5 CP / 1.5 w.p.s.	6.4 RSM Resilience Strategies & Measures (Fload, Drought, Sea Level, Hurricane) Dr. Nadine Kuhla von Bergmann / DiplIng. Nicole Barran 1.5 CP / 1.5 w.p.s.	7.4 DFI Digitalization, Financial Innovation & Financial Tech. Part Dr. Tobias Popovic / Dr. Sebastian Glock 1.5 CP / 1.5 w.p.s.	8.4 LS Leadersl Manager Dr. Nadir 1.5 CF

NOTE: IN ADDITION LECTURERS OF MODULES 1-8 CONTRIBUTE TO SUPERVISION OF RESPECTIVE CASE STUDY CHAPTERS (0.5 OUT OF 1.5 W.P.S. PER LEARNING UNIT) * JOINT LECTURES WITH IITM STUDENTS

LU 9.2 / CS 2 CASE STUDY 2 FOCUS: INFRASTRUCTURE, MANAGEMENT & FINANCE AP: Prof. R. Dieterle, Dr. N. Kuhla v. Bergmann, NN (Finance); NN (Resources); NN (Energy, Mobility) 6 CP / 6 w.p.s.

FIG. 28 UNIVERSITY OF APPLIED SCIENCES STUTTGART. CURRICULUM & MODULES OF SMART CITY MASTER PROGRAM.

CURRICULUM & MODULES

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U**LE 8 GM** GOVERNANCE, ENS & MANAGEM.

rof. Dr. Rein **6 w.p.s.**

PG es of Public Policy & ance Sobine Rein / rea Bräuning

P / 1.5 w.p.s.

SS ervices & Public Sector ement Sobine Rein

P / 1.5 w.p.s.

AM Agile Management thes bland Dieterle

P / 1.5 w.p.s.

SM ship & Stakeholder ement ine Kuhla v. Bergmann

P / 1.5 w.p.s.

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