TRAJNOSTNO OBLIKOVANJE KVALITETNEGA BIVALNEGA OKOLJA, POROČILO O DELU

SUSTAINABLE PLANNING FOR THE QUALITY LIVING SPACE, RESEARCH REPORT

PROGRAM ARRS št. P5-0068, 2013-2017

Vsebina

Vsebina raziskovalnega programa je bila razdeljena na tri vsebinsko različne tematske sklope:

A) Razvoj sodobnih konceptov arhitekture in urbanizma, vezanih na specifiko arhitekturnega prostora in kulturno dediščino v Sloveniji. Raziskave v tem sklopu so predvsem povezovale in razvijale arhitekturno in urbanistično teorijo, pri čemer so bile v prvem letu raziskav v glavnem razdeljene na naslednje vsebine: a) poglabljanje poznavanje specifik arhitekturnega prostora v Sloveniji, b) spodbujanje razvoja kritičnega odnosa do naravne in kulturne dediščine, c) razvoj teoretskih interpretacij preteklosti za izzive sodobnosti in d) razvoj sodobnih konceptov projektiranja, ki temelji na trajnostni rabi, racionalnosti, varnosti in prepoznavnosti prostora. Posebno pozornost smo posvetili slovenski specifiki razvoja metode reflektivnega projektiranja, ki združuje vse štiri navedene aspekte. Gre za razvoj arhitekturne prakse kot raziskovalnega laboratorija, za katerega je potrebno razviti metode eksplikacije oblikovalskega znanja, inherentnega v oblikovalskem procesu. Identifikacija spoznanj o prostorski inteligenci in o oblikovalskem delovanju v specifičnih socio-prostorkih kontekstih, ter metod, ki to eksplikacijo omogočajo, poteka v okviru konzorcija partnerjev projekta ADAPT-r, v katerega je programska skupina vpeta. Vloga programske skupine je v transformaciji in integraciji globalne metode v trans-regionalni prostor, z identifikacijo in upoštevanjem arhitekturne raziskovalne tradicije našega kulturnega okolja.

B) Raziskave, vezane na projektiranje in tehnologijo trajnostnih nizkoenergijskih hiš so bile vezane predvsem na zahteve Pravilnika o učinkoviti rabi energije v stavbah (Ur. l. RS 31/2010), ki zahteva gradnjo skoraj ničenergijskih stavb vseh javnih objektov že v nekaj letih. S povečevanjem debeline izolacije pa se pojavljajo številni problemi vezani na konstrukcijsko odpornost stikov vertikalnih in horizontalnih nosilnih elementov sklopov, ki se v praksi rešuje stihijsko brez pravih teoretičnih raziskav, predlagani koncepti pa pogosto podrejajo konstrukcijsko varnost drugim zahtevam podrejenim energetski učinkovitosti toplotnega ovoja stavbe. Popolnoma odrinjen problem pri tem predstavlja potresna varnost vseh objektov, ki so v Slovenijo prineseni iz drugih okolij, ki potresno niso ogrožena. V tem pogledu naše delo nadaljuje raziskave zaključenega raziskovalnega projekta ARRS iz prejšnjih let, v okviru dela na raziskovalnem programu P50068 pa smo izvedli bistveno natančnejše simulacije obnašanja konstrukcij na toplotni izolaciji, ki so temeljile na nelinearnem modelu zgornje konstrukcije, nelinearnem modelu toplotne izolacije in temeljnih tal (vertikalne in strižne vzmeti) ter dinamični analizi za različne potresne zapise značilne za Slovenijo. Ugotovili smo, da pri vgradnji toplotne izolacije pod temeljno ploščo pri močnem potresu lahko pride do stiskanja izolacije, zmanjšanja toplotnih karakteristik in nagibanja

Content

The proposed research program is divided in three thematically different parts:

A) *Development of contemporary concepts of architecture and urban design in relation to the specific of Slovene architecture and protection of architectural and cultural heritage. Research in this section was focused in the following fields: a) indepth knowledge of Slovenian architectural characteristics, b) development of a critical creativity preserving natural and cultural heritage, c) development of theoretical interpretations of the past for the challenges of the future and d) development of contemporary concepts of rationality, security and space recognition. Special attention has been given to the development of the reflective design method, considering the Slovenian specifics. All four of the above aspects were considered. The method treats architectural practice as a research laboratory for which new procedures of design know-how, inherent in the design process, need to be considered. The identification of knowledge regarding spatial intelligence and design procedures for specific socio-spatial contests takes place in a form of a consortium of the project ADAPT-r in which the research group is also included. The role of our research group is in transforming and integrating the global method into a trans-regional space with identification and implementation of the existing architectural research tradition.*

B) *Research related to design, technology and detailing of sustainable low energy houses were based on the Efficient energy in buildings guidelines (PURES, Ur. l. RS 31/2010). The guidelines impose a nearly zero energy building concept for all public buildings after 2018 and for all new buildings after 2020. Construction practice has already responded to these demands by increasing the thickness of the thermal insulation layer of building envelopes. It is obvious in these cases that the main component governing the overall building dimensions is not the loadbearing structure anymore. The initial design concepts of low energy structures originate from Northern Europe, where the seismic activity is low. Such buildings have therefore not been designed to withstand higher seismic loadings that are for instance typical for Slovenia. In this sense our work in the research group continues the research of the ARRS research project from previous years. In the scope of work performed in the research programme P50068 we have carried out detailed simulations of the behaviour of low-energy buildings that are founded on a layer of thermal insulation. The computer simulations are based on nonlinear behaviour of the superstructure and on a nonlinear model of the insulation layer, including soil conditions. Actual earthquake records have been used that simulate realistic*

objekta. Poleg tega lahko pride tudi do povečanja potresnih vplivov na zgornjo konstrukcijo. Oboje je mogoče preveriti z ustreznim statičnim računom pri potresni obtežbi, v naših raziskovalnih in strokovnih člankih pa je točno opisano v katerih primerih in za kakšne stavbe je ta natančnejši račun potresne obtežbe potreben in v katerih ne, kot je tudi opisan predlagan računski statični model, ki ga mora uporabiti projektant v praksi. Navedeni rezultati se že prenašajo v prakso v obliki strokovnih izobraževanj za gradnjo pasivnih hiš, ki jih s sodelavci in partnerji iz gospodarstva organiziramo na FA. V tem tehnološkem sklopu raziskav je bila razvita tudi enostavna metoda za vrednotenje trajnostnih zasnov energijsko učinkovitih družinskih hiš. Ugotavljamo, da imajo stavbe negativne vplive na okolje v celotnem življenjskem ciklusu, torej od faze pridobivanja surovin ter proizvodnje gradiv in polizdelkov, do prodaje, vgradnje in uporabe do končne faze odstranitve, ko stavba odsluži svojemu namenu. Trenutna zakonodaja omejuje v glavnem rabo energije in emisije v obratovanju, manj pa ostale parametre, ki prav tako definirajo zasnovo sodobne trajnostne stavbe. Preverjanje trajnostne zasnove stavbe je smiselno že v začetnih fazah projektiranja, ko je še mogoče vplivati na rezultat. Rezultat raziskave je enostavna metoda, s pomočjo katere se z izbranimi petimi indikatorji ocenjuje kakovost trajnostnih zasnov. Področja ocenjevanja se nanašajo na energijsko učinkovitost, rabo primarne energije, emisije CO_2, stroške ter na doseženo bivalno ugodje. Ocenjevanje s pomočjo indikatorjev poteka po treh načinih objektivnega in subjektivnega ponderiranja, s čimer se v skupno oceno vključijo vidiki neodvisnosti presojevalca ter vidiki nacionalnih in uporabniških zahtev.

C) Raziskave metod dialoga in izobraževanja o trajnostnem prostorskem razvoju v arhitekturi in urbanizmu. Ta sklop je obravnaval arhitekturno in urbanistično izobraževanje, ter med-disciplinarno in medgeneracijsko sodelovanje v procesu oblikovanja prostora. Cilj raziskav je bil v tem sklopu usmerjen predvsem v razvoj organizacijskega, med-disciplinarnega in medgeneracijskega dialoga o trajnostnem prostorskem razvoju. Med rezultati prvega leta izpostavimo razvoj novega sistema vizualnih digitalnih orodij za sodelovanje in izobraževanje javnosti v prostorskem načrtovanju (DSO). Sistem je razdeljen na več sklopov in sestavljen iz posameznih vizualnih digitalnih orodij, ki se med seboj dopolnjujejo ter tvorijo celoto: informiranje, komuniciranje, sodelovanje in izobraževanje. Povezava med sistemom arhitekturnega in urbanističnega načrtovanja s sistemom vseživljenjskega učenja je bila preverjena z razvojem novega sistema vizualnih digitalnih orodij za sodelovanje in izobraževanje javnosti v prostorskem načrtovanju (DSO).
Poročilo sestoji iz skupnega dela, ki opisuje potek in nekatere izbrane znanstvene in družbeno ekonomske dosežke dela na programu in sedmih individualnih delov, ki opisujejo raziskovalno delo udeleženca posameznika. Individualni prispevki predloženega poročila vključujejo:

1) Izzivi in priložnosti arhitekture modernizma (Tadeja Zupančič)
2) Raziskovanje poselitvenih vzorcev in 'mreženje' v prostoru (Alenka Fikfak),
3) Obalne preobrazbe (Lučka Ažman Momirski)
4) Sredozemska terasirana pokrajina: spremembe v rabi tal (Lučka Ažman Momirski)
5) Metode in orodja za ocenjevanje trajnostnih enodružinskih hiš (Martina Zbašnik-Senegačnik)

seismic characteristic that are typical for Slovenia. It has been found out that by inserting a layer of thermal insulation under the foundation slab in a seismic event with a high magnitude, can lead to inelastic deformations of the insulation layer, thus reducing its insulation properties. Several research and professional papers that we have published in the scope of the programme describe in detail in which cases and for what types of buildings a more detailed seismic analysis is needed. A refined mathematical model for construction practice was also developed and is described in the aforementioned papers. The results have already been transferred to construction practice in the form of seminars on passive house construction that are organised in cooperation with partners from the industry. In this technological scope of research a new, simplified method for the valorisation of sustainable design concepts of family houses was developed. The results show that buildings produce a negative impact on the environment in their life-cycle – from the phase of raw material production, fabrication of materials and semi-manufactured elements to the marketing, usage and final removal after the building finished working life. The legislation is mainly focused to the energy consumption and emissions produced during the normal usage of the building, while energy consumption in other life cycles is often neglected. The results of conducted study is a simple method which uses five selected indicators to verify the sustainability of design of particular building structure. The areas to be evaluated are energy efficiency, use of primary energy, CO_2 emissions, costs, and the level of living comfort achieved. The evaluation using these indicators is carried out using three subjective and objective weighting methods, such that the final evaluation includes the viewpoints of an independent evaluator and the points of view of both the user and the state.

C) *Research related to dialog methods and education in sustainable spatial development in architecture and urbanism. This section analysed the architectural and urban education and interdisciplinary and multigenerational cooperation in the process of spatial development. The goal of the research was aimed in the development of organisational, interdisciplinary and multigenerational dialogue aimed at sustainable spatial planning. From the results obtained in the first year we want to highlight the development of a new digital tool for cooperation and education of general public in spatial planning (DSO). The system is divided into multiple sections and comprises from specific visual digital tools which complement each other and form a uniform system for: information, communication, cooperation and education. The connection between architectural and urban planning with the system of lifelong learning was also investigated with the development of DSO.*
This report comprises of a common part that describes the procedures and some selected scientific and socio-economic achievements of the programme. Seven individual contributions by programme members are also included, representing their individual research work. The following topics are presented:

1) Challenges and opportunities of modernist architecture (Tadeja Zupančič)

6) Spremembe testa miselne rotacije (Domen Kušar)
7) Dialog in izobraževanje o prostorskih trajnostnih vprašanjih v arhitekturi in urbanizmu (Matevž Juvančič).

Doseženi cilji in rezultati raziskovalnega projekta
Rezultati dela na programu se ne kažejo samo v obliki znanstvenih člankov, temveč tudi v velikem številu objavljenih strokovnih člankov, monografij, delov monografij, delavnic, seminarjev, izobraževanj in izdanih knjig, ki so razvidni iz bibliografije celotne skupine.

Sodelavci / *Participants*
Vojko Kilar (vodja projekta), Martina Zbašnik-Senegačnik, David Koren, Domen Kušar, Tomaž Slak, Tadeja Zupančič, Lucija Ažman-Momirski, Simon Petrovčič, Srečko Vratuša, Edo Wallner, Boris Azinović – mladi raziskovalec (UL-FA)
Tatjana Isaković (UL-FGG)
Milan Kuhta, Simon Šilih, Erika Kozem (UM-FG)
Samo Gostič, Mihael Mirtič (Gradbeni Inštitut ZRMK d.o.o.)

2) Researching settlement patterns and spatial 'networking' (Alenka Fikfak)
3) Waterfront redevelopment (Lučka Ažman Momirski)
4) Mediterranean terraced landscapes: Land use changes (Lučka Ažman Momirski)
5) Methods and tools for evaluation of sustainable single-family houses (Martina Zbašnik-Senegačnik)
6) Changes of Mental rotating test (Domen Kušar)
7) Dialogue and education about spatial sustainable issues in architecture and urban design (Matevž Juvančič).

Achieved goals and research results
Research results are not only presented in research papers, but also in professional papers, monographs, parts of monographs, workshops, seminars which are presented in the bibliography of the entire research programme group.

Nekateri izbrani rezultati pri katerih so sodelovali člani programske skupine / Selected bibliographical results

Znanstveni članki / *Scientific papers*

PRAZNIK, Miha, BUTALA, Vincenc, ZBAŠNIK-SENEGAČNIK, Martina. Simplified evaluation method for energy efficiency in single-family houses using key quality parameters. V: Energy and buildings, Dec. 2013, vol. 67, str. 489-499.

SVETINA, Matija, ISTENIČ STARČIČ, Andreja, JUVANČIČ, Matevž, NOVLJAN, Tomaž, ŠUBIC KOVAČ, Maruška, VEROVŠEK, Špela, ZUPANČIČ-STROJAN, Tadeja. How children come to understand sustainable development: a contribution to educational agenda. V: Sustainable development, Jul./Aug. 2013, vol. 21, iss. 4, str. 260-269.

KILAR, Vojko, KOREN, David, BOKAN-BOSILJKOV, Violeta. Evaluation of the performance of extruded polystyrene boards : implications for their application in earthquake engineering. V: Polymer testing, 2014, letn. 40, str. 234-244.

SLAK, Tomaž, CEROVŠEK, Tomo, ZUPANČIČ-STROJAN, Tadeja, KILAR, Vojko. A comperative study of model-based framework for the AEC competency evaluation of building tenders. V: Tehnics tehnologies education management, vol. 8, no. 1, str. 449-463.

PRAZNIK, Miha, BUTALA, Vincenc, ZBAŠNIK-SENEGAČNIK, Martina. A simple method for evaluating the sustainable design of energy efficient family houses. V: Strojniški vestnik, Jun. 2014, vol. 60, no. 6, str. 425-436.

AZINOVIĆ, Boris, KOREN, David, KILAR, Vojko. Principles of energy efficient construction and their influence on the seismic resistance of light-weight buildings. V: The open civil engineering journal, 2014, vol. 8, str. 105-116.

ČEFERIN, Petra. Što to radi arhitektura? = What (in the world) is architecture doing? Oris, 2013, god. 15, br. 83, str. 110-123.

KOMAC, Blaž, ZORN, Matija, KUŠAR, Domen. Uporaba evidence vrednosti nepremičnin za ocenjevanje škode zaradi naravnih nesreč v Sloveniji = Use of the real estate register for assessing property damage caused by natural disasters in Slovenia. V: Ujma, ISSN 0353-085X, 2013, št. 27, str. 153-158.

FIKFAK, Alenka. Quality of architectural education at the Faculty of Architecture of the University of Ljubljana. V: Journal of architecture and urbanism, 2013, vol. 37, iss. 4, str. 257-267.

Nekateri drugi pomembni rezultati programske skupine / *Other important works*

AŽMAN MOMIRSKI, Lučka, AŽMAN MOMIRSKI, Lučka (urednik), BERČIČ, Tomaž (urednik), 1975- KOCIPER, Gašper (urednik). Obalne preobrazbe : Izola vzhod. 1. izd. Ljubljana: FA, 2013. 80 str.

ČEFERIN, Petra. Non-serving architecture. V: Status Quo Vadis : die Zukunft der Architektur als Prognose und Programm = a prospectus on the future of architecture, (Um Bau, ISSN 0256-2529, 26). Salzburg: Verlag Anton Pustet, cop. 2013, [Bd.] 26, str. 43-53.

FIKFAK, Alenka. Domačija v Goriških Brdih : razvoj domačije preko individualne tipske hiše v sodoben kmetijski kompleks. V: ZULJAN KUMAR, Danila (ur.), GOMIRŠEK, Tanja (ur.). Brda in Brici : o ljudeh, zgodovini, jeziku, besedni umetnosti, stavbarstvu in rastlinstvu Brd. Občina Brda, 2013, str. 57-72.

JUVANČIČ, Matevž, ZUPANČIČ-STROJAN, Tadeja. The fusion of clever urban initiatives and digital applications : teaching architects and urban designers how to make apps for the public involvement. V: THOMPSON, Emine Mine (ur.). Fusion : data integration at its best. Vol. 1. 1st ed. Northumbria: eCAADe, cop. 2014, str. 99-108

KILAR, Vojko, AZINOVIĆ, Boris, KOREN, David. Energy efficient construction and the seismic resistance of passive houses. V: International science conference, April 08-09, 2014, Dubai UAE, (International Science Index, vol. 8, no. 4). Dubai: [World Academy of Science, Engineering and Technology], 2014, str. 83-89.

LIKAR, Darko. Odkrivanje ostankov notranjega mestnega starega obzidja v Kopru. Annales, Series historia et sociologia, ISSN 1408-5348, 2013, letn. 23, št. 1, str. 71-90.

ZBAŠNIK-SENEGAČNIK, Martina. Zasteklitve in toplotna bilanca stavbe. V: Gradbenik, ISSN 1408-1725, apr. 2013, letn. 17, št. 4, str. 14-15.

ZUPANČIČ-STROJAN, Tadeja, JUVANČIČ, Matevž. Management vision development guidelines : managing ATRIUM vision and network structure. V: ZUPANČIČ-STROJAN, Tadeja (ur.), et al. Manual of wise management, preservation, reuse and economic valorisation of architecture of totalitarian regimes of the 20th century. Forli: Municipality; Ljubljana: FA, 2013, str. 143-146.