Sandro Parrinello
Anna Dell'Amico

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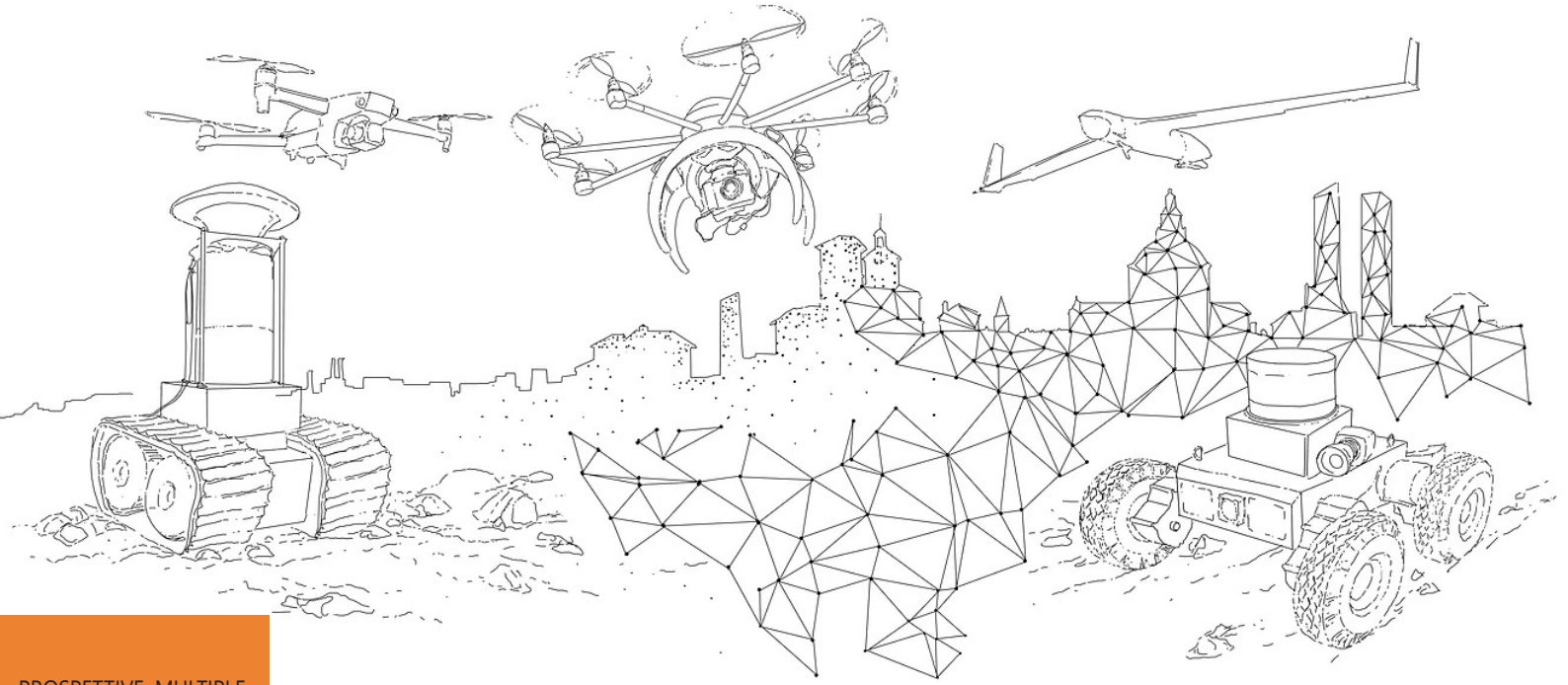
editors

D-SITE

Drones - Systems of Information on culTural hEritage for a spatial and social investigation

Volume 2



PROSPETTIVE MULTIPLE
STUDI DI INGEGNERIA ARCHITETTURA E ARTE

PaviaUniversityPress

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Anna Dell'Amico

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Drones - Systems of Information on Cultural Heritage for a spatial and social investigation

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D-SITE, Drones - Systems of Information on Cultural Heritage for a spatial and social investigation / Sandro Parrinello, Salvatore Barba, Anna Dell'Amico, Andrea di Filippo (edited by) - Pavia: Pavia University Press, 2022. - 684 p.: ill.; 21 cm.

(Prospettive multiple: studi di ingegneria, architettura e arte)

ISBN 978-88-6952-159-1
ebook 978-88-6952-160-7

The present publication is part of the series "Prospettive multiple: studi di ingegneria, architettura e arte", which has an international referee panel. "D-SITE, Drones - Systems of Information on Cultural Heritage for a spatial and social investigation" is a scientific text evaluated and approved by double blind peer review by the Scientific Editorial Board.

Translation of chapters and treatment of citations and bibliography are due to the respective authors.

Pavia University Press
Edizioni dell'Università degli Studi di Pavia
info@paviauniversitypress.it
www.paviauniversitypress.it

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Graphic project
Anna Dell'Amico, Francesca Picchio, Anna Sanseverino

On cover: Drawing by Francesca Picchio and Sandro Parrinello
First edition: june 2022.

Stampa: Logo S.r.l. – Borgoricco (PD)

The volume consists of a collection of contributions from the conference "D-SITE, Drones - Systems of Information on Cultural Heritage for a spatial and social investigation". The event, is organized by the experimental laboratory of research and didactics DAda-LAB of DICAr - Department of Civil Engineering and Architecture of University of Pavia, and MODLab of DICIV - Department of Civil Engeenering of University of Salerno. The publication co-funded by the the University of Pavia, the University of Salerno, and the Italian Ministry of Foreign Affairs and International Cooperation.

D-SITE Conference is organized by:

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University of Pavia

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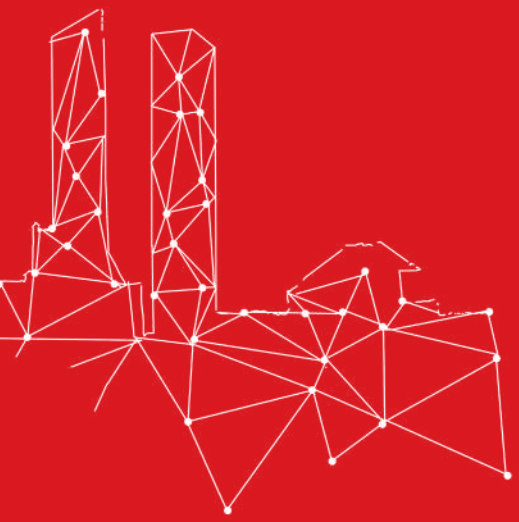

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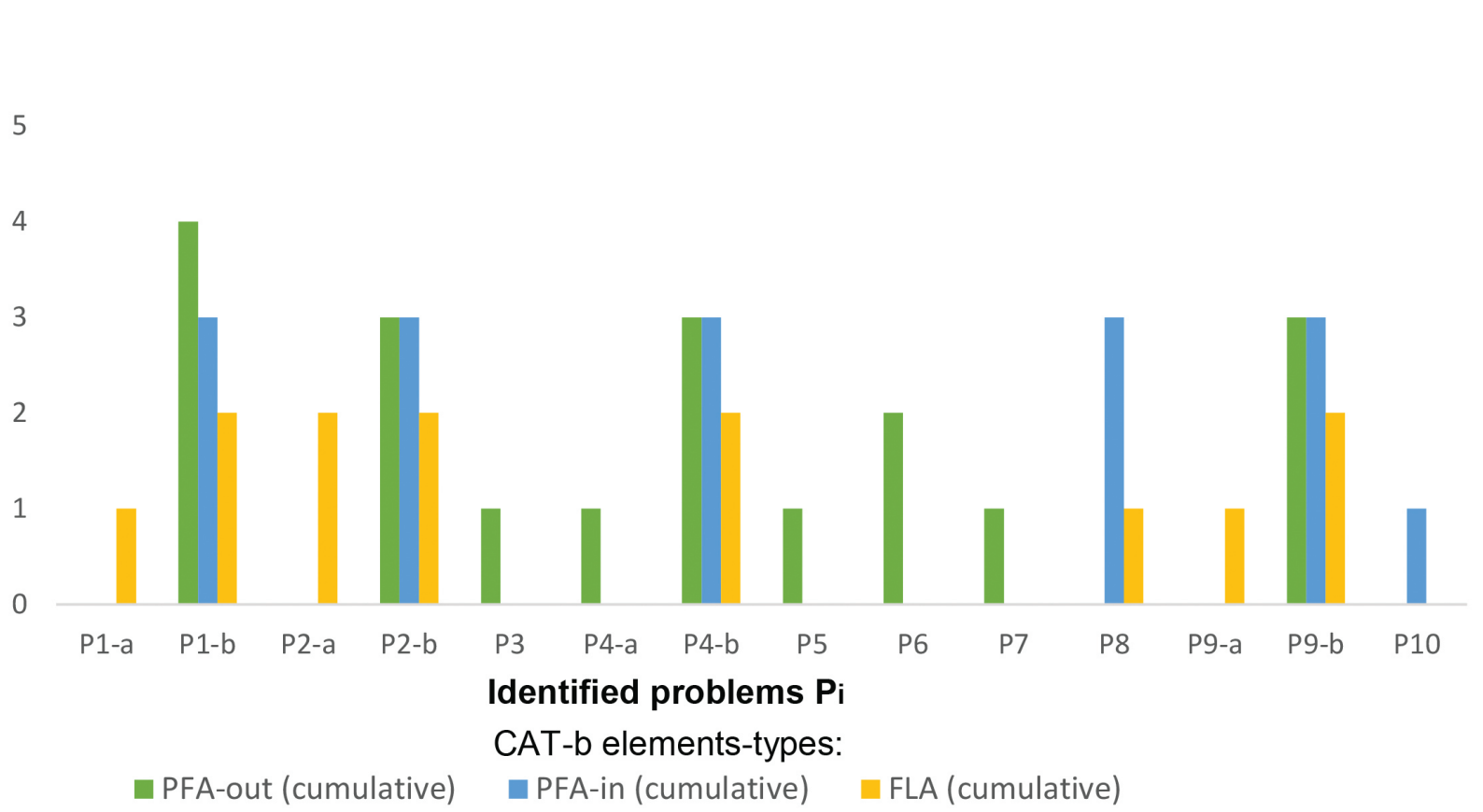

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Keywords:
UAV/UAS, legislation, architectural heritage, Serbia.

ABSTRACT

Worldwide quickly enacted UAV/UAS legislative is permanently improving to prevent unpredicted and potentially hazardous activities. Serbian regulations have generally been harmonized with those of the EU and strictly implemented.

This Paper investigates Serbian regulatory mechanisms negatively affecting surveying effectivity/efficiency. Respecting the methodology, valorisation criteria are set and problems identified. Research results are graphically presented to mutually compare them and obtain sustainable conclusions.

Regulatory and controlling mechanisms on UAV/UAS that influence efficient architectural heritage praxis: actual situation in Serbia

1. Introduction

Serbian UAV/UAS-related legislation generally harmonized with that of the EU, combines national (CAD) and European (EASA) indications to satisfy all requirements. Its strict implementation, legislative and administrative limitations included, especially for operation in densely-populated central city zones or in restricted flight areas, are recognized here as main effectivity/efficiency destructor factors. Thus, to obtain a specific authorization may prove to be extremely complex and long, causing not to complete activities aims. The time between defining needs and flight may take weeks or months to be conducted. It may hinder urgent surveying, preventing private users to operate in emergency conditions. This Paper dominantly investigates negative Serbian regulatory and controlling mechanisms' influence on surveying effectivity/efficiency, reflecting possible solutions to reduce the risk of "missing the opportunity" without breaking the rules. Three central questions are analysed: (1) difference in subject-related mechanisms in EU and Serbia), (2) common mechanisms affecting UAV/UAS surveying of Cultural Heritage sites (hereinafter: "CHS") and (3) aspects of UAV/UAS Cultural Heritage surveying negatively affected by those mechanisms. To conduct this in a scientific manner, sustainable research methodology is defined. Therefore, valorisation criteria are set, current legislative framework investigated and problems identified. Following this, research results are cross-referenced and presented in the form of charts to mutually compare them and obtain sustainable conclusions. A "more global" importance of this study is that this set of problems restrictively influences UAV/UAS surveying of Cultural Heritage sites throughout EU.

2. Previous research

Previous research in this field concentrated on legislative overviews of national and global situations regarding different tangent aspects: (a) control of UAV/UAS during flights above urban environments to make them more secure - legislative-wise and technologically (in Spain concretely) (Chamoso et al.,2018) and (b) laws required to protect the public amid rising concerns about privacy, interference with commercial flights and potential risk to homeland security so to balance between risks and benefits (Kurt,2015), Another thematically connected topic of interest is a review of the state UAV regulations were globally used in 2017 and prior (Stöcker et al.,2017). It emphasizes the importance, impact and diversity of UAV regulations in 19 countries worldwide and presents comparatively the current state of national legislation and its influence on general droning activity. But, elaboration and valorisation of analysed data do not consider the situation in Serbia. Recent and complex comparative analysis of legislation evolution referring to operating a drone in OECD Countries (Serbia excluded) centres on size, weight, flight altitude, purpose of use and restrictions with reference to legal documents and relevant authorities. It is followed by recommendations to harmonize and update legal framework (Tsiamis et al.,2019). An overview of existing EU drone regulations (applicable since 1 January 2021) and main changes to the rules since first regulations were adopted in 2017 are represented in paper (Alamouri et al.,2021). It reveals how new rules help or hinder the use of UAS technology and its economic potential in scientific and commercial sectors. Contribution of this paper is graphically shown on figure 1.

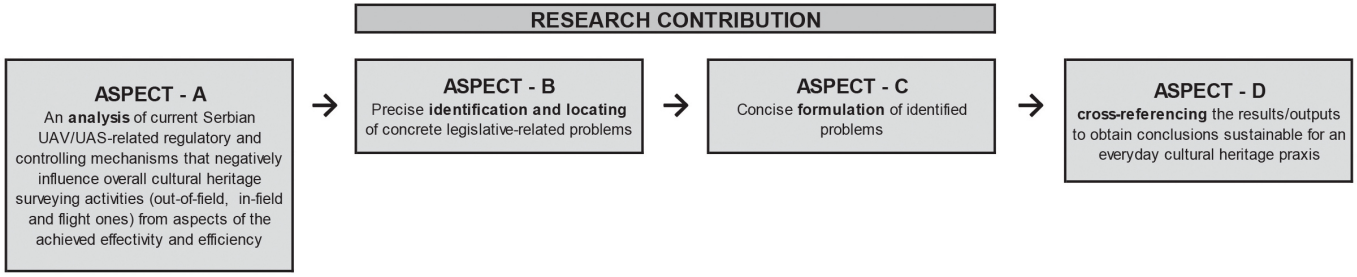

Figure 1. Graphic Illustration of the main aspects of this research contribution.

3. Initial considerations, prerequisites and assumptions

Legislation concerning drones officially EU-labelled with C1 and C2 (take-off mass up to 4kg), is considered hereunder, because they are mainly used for professional work in CHS UAV/UAS surveying. Also, instead of laser scanning, photogrammetric activities, generally more affordable and hence more applicable in everyday global CHS surveying praxis are considered. Due to the research aim, UAV/UAS surveying activities which relate to post-processing of data acquired in-field are not considered.

The assumption is that surveying staff is well educated so that its effectivity/efficiency does not affect the overall effectivity/efficiency of performed UAV/UAS surveying.

3.1. Overview of "Inherited" EU Regulation and Controlling Mechanisms

Although Serbia is not officially an EU country, Serbian Civil Aviation Authority (CAD) has issued national manned and unmanned aircraft regulations complied with EU Regulation 2018/1139 [6]. Serbia's regulation also covers issues EU member states are responsible for pursuant to EU Commission Delegated Regulation 2019/945 [7] and EU Commission Implementing Regulation 2019/947 [8], including changes applicable since January 1st 2021 (Alamouri et al.,2021). Registering on the D-Flight portal is still not mandatory in Serbia, as is affixing a QR code to a drone for identification purposes and any operational liability issues that may arise thereof. Generally, until January 1st 2023, drones without class marking can be used in limited open category, where national authorities usually may impose additional requirements on the pilot. But, CAD has decided to remain aligned with open categories of EU Regulation 2018/1139 and has not imposed additional requirements on pilots of unmarked drones. Also, the CAD regulation has not yet granted a transitional period to ensure gradual conversion from the use of previous certifications to those granted in compliance with the EU Aviation Safety Agency requirements.

3.2. Current Serbian UAV/UAS-Related Regulatory, Controlling Bodies and Legislation

Serbian authorities tasked in Table 1 are in charge of mechanisms controlling UAV/UAS surveying activities regulated by Serbian legislative.

The most important forms of national UAV/UAS-related legislative are presented in Table 2.

ID	Authority	Web Address
CAD	Civil Aviation Directorate of the Republic of Serbia	http://www.cad.gov.rs/en
SMA	SMATSA - Serbian and Montenegro Air Traffic Services	https://smatsa.rs/en/4166-2/
MOI	Ministry of Interior of the Republic of Serbia	http://www.mup.gov.rs/wps/portal/en
MOD	Ministry of Defence of the Republic of Serbia	https://www.mod.gov.rs/eng

Table 1. Serbian UAV/UAS-related regulatory and controlling authorities.

ID	Legislative	Issue
LAW-1	Air Transport Law (Consolidated version)	"Official Gazette of the Republic of Serbia" No 73/10, 57/11, 93/12, 45/15, 55/15- other Law, 83/18 and 9/20
LAW-2	Law on Public Peace and Order	"Official Gazette of the Republic of Serbia", No 6/2016 and 24/2018
LAW-3	Law on Defence	"Official Gazette of the Republic of Serbia", No 116/2007, 88/2009, 104/2009, 10/2015 and 36/2018
REG-1	Regulation on Unmanned Aircraft	"Official Gazette of the Republic of Serbia", No 1/20
REG-2	Regulation on Aeronautical Information	„Official Gazette of the Republic of Serbia", No 142/20 and 61/21
REG-3	Regulation on Aircraft Flight	„Official Gazette of the FRY ", No 40/95 and 68/2001
DEC-1	Decree on Airspace Management	"Official Gazette of the Republic of Serbia", No 86/19
DEC-2	Decree on the Procedure for Issuing Permits for Aerial Photographing of the Territory of the FRY and for Issuing Cartographic and Other Publications	„Official Gazette of the FRY ", No 54/94 and „Official Gazette of the Republic of Serbia", No 72/2009
DES-1	Decision on the form of Flight Approval Application	Issued by CAD (Civil Aviation Directorate of the Republic of Serbia)
DES-2	Decision on General Rules of Conduct in Housing and Residential/Office Buildings	Issued by each town/municipality government separately

Table 2. Serbian UAV/UAS-related legislative in the form of laws and bylaws.

4. Methodology setup

To identify, analyse and systematize data scientifically and obtain meritorious conclusions, a set of initial terms, definitions and categorizations is defined.

4.1. Terms, Definitions and Categorizations Used

For this investigation, the targeting experimental field is a "controlled surveying-activity space" (hereinafter: "CSAS"), whereby that "space" is not spatial but made of various UAV/UAS-related elements divided into categories (hereinafter: "CAT"): CAT-a *legislative elements*, CAT-b *professional surveying activity elements* and CAT-c *elements that represent causal links between elements from two previous categories*.

The CAT-a is made of hierarchically-ordered legislative elements:

laws, including corresponding articles and paragraphs (hereinafter: "LAW") and bylaws, including corresponding articles and paragraphs (hereinafter: "BLW").

CAT-b elements are divided into two hierarchically-ordered sub-categories: Non-flight activities in the form of various Pre- and Post-flight activities: out-of-field and in-field (hereinafter: "PFA-out and PFA-in") and flight activities (hereinafter: "FLA") related to in-field surveying procedures (inspection and mapping).

CAT-c elements are links between proper elements of CAT-a and CAT-b, describing how concrete legislative mechanism(s) influence(s) targeted activity(ies) realization. Investigation of each link allows identification of not only positive, but also negative aspects of their presence and, consequently, valorisation of their potential effects on overall professional surveying practice. Note that some of those links can be "one-directional" (single CAT-b element is affected by one CAT-a element), while others can be "multi-directional" (more CAT-b elements are affected by one CAT-a element). As each of one - or multi-directional links is in the form of implication (directed from CAT-a to CAT-b), overall "sustainability" of CAT-a elements (relevant for concrete CSAS surveying) can be valorised by achieved "successfulness" of CAT-b elements performed by strictly respecting existence of those CAT-a elements.

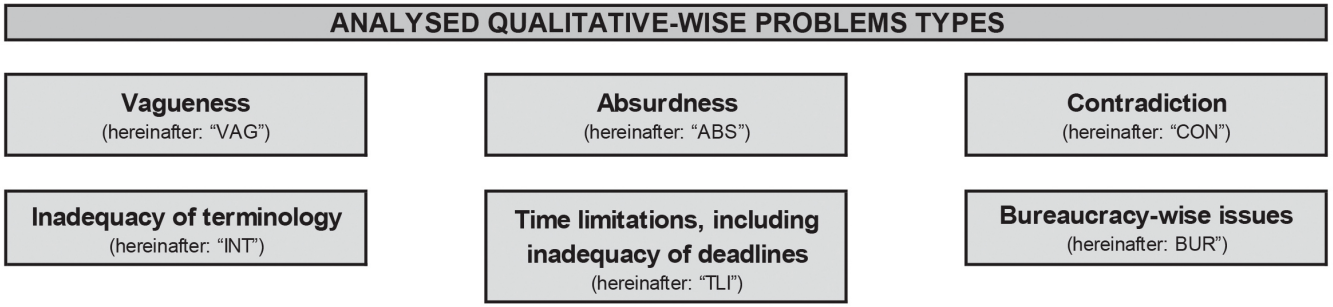

Figure 2. Typology of potential qualitative-wise problems identified as most relevant and expected.

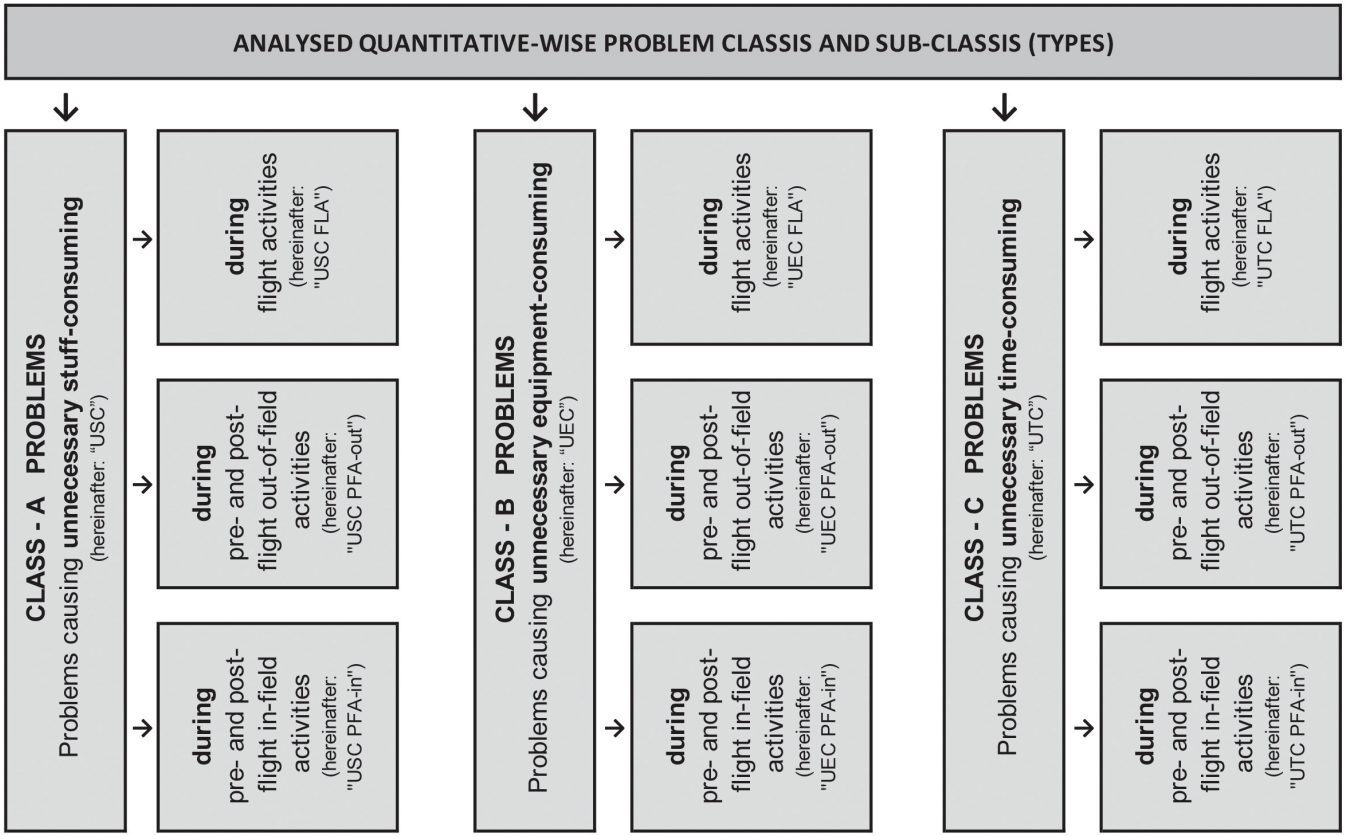

Figure 3. Typology of potential quantitative-wise problems identified as most relevant and expected.

To define "successfulness" of CAT-b elements as a measure of mentioned CSAS sustainability, namely, of sustainability of CAT-a elements, two criteria are introduced: effectiveness and efficiency.

In this paper, effectiveness (hereinafter "EFT") is successfulness of obtained results of realized surveying activities (here represented as a ratio between planned and achieved results obtained under strict respect for corresponding legislative).

Conversely, efficiency (hereinafter "EFC") is successfulness of realized surveying activities (obtained results) in the function of overall resources used (staff, equipment and time).

But, recalling that effectiveness and efficiency are substantially strongly interconnected, they are valorised together according a common EFT/EFC criteria. So, this successfulness is valorised in this paper only considering whether CAT-b elements are affected by CAT-a elements or not with regard to those criteria. Thus, each link indicating negatively effect(s) on outcome successfulness is declared "problematic". Consequently, CAT-a element, part of the "problematic" link, is declared "problematic" also. So, this methodology allows not only to identify legislative-wise problem (in CAT-a hierarchy) but to formulate and systematise it to

help relevant institutions find solutions adequately (satisfying professional practice demands in the most proper way).

4.2. Typology and Classification of Potential UAV/UAS-Related Problems

To represent more comprehensively potential problems from EFT/EFC point of view (as research outputs), they are categorized qualitatively and quantitatively. A set of potential most relevant and expected qualitative-wise problems is shown on figure 2 (together with corresponding abbreviations used further in text).Three identified classes of potential most relevant and expected quantitative-wise problems is shown on figure 3 (together with corresponding abbreviations used further in text). With regard to meaning of "efficiency", it is obvious that CAT-b elements efficiency is directly (negatively) affected by problem types classified above.

5. Investigated inputs and outputs

Concrete research inputs and outputs are presented tabularly and marked with respect to abbreviations defined above.Regarding methodology criteria in Section 4, national legislative framework is analysed (following current professional experience in field of interest), relevant links inspected and problem causes (marked with C_i) localized in corresponding legislation hierarchy (Table 3[1]). Concise description of identified and previously localized problems causes C_i (generated by problematic links in Table 3) is in Table 4. Following information in Tables 3 and 4, problems (marked with P_i) are concisely formulated (Table 5). Table 6 features typology of problems formulated according to quantitative-wise and qualitative-wise problems-characterization criteria described in Chapter 4.Occasioned relations between analysed CAT-b elements and formulated problems P_i (Table 5) are in Table 7. Data in Tables 6 and 7 are graphically presented in the form of charts (Chart 1, i.e. Chart 2). Chart 1 represents the number and abundance of problems P_i expressed in the function of analysed quantity-

CAT-a elements	ID	LAW			BLW						
		LAW-1	LAW-2	LAW-3	REG-1	REG-2	REG-3	DEC-1	DEC-2	DES-1	DES-2
	LAW-1										
	LAW-2				C_4[11÷12]						
	LAW-3				C_4[102v÷26]				C_4[102v÷2]		
	REG-1				C_i [16] C_2 [11,14/1] C_i[8,9]			C_4[13÷15/1-2] C_4 [15,18÷15/1-3]	C_4[26÷2]		
	REG-2										
	REG-3										
	DEC-1										
	DEC-2										
	DES-1									C_5	
	DES-2										C_5

Table 3. Localization of problems causes Ci in CAT-a hierarchy.

and quality-wise problems-characterization criteria. Chart 2 represents an influence of identified problems P_i on CAT-b elements of analysed types: PFA-out (cumulative), PFA-in (cumulative) and FLA (cumulative).

6. Comments and conclusions

With regard to Chart 1, one can conclude the following: There are: 9 quantity-wise problems of 2 quality-wise problem types classified as ABS and BUR, 8 TLI-type problems, while 4 of VAG-type. The highest number of problems are BUR-type (25), 11 are ABS-type, 8 are TLI-type, while the smallest number (4) is of VAG-type. According to abundance of quantity-wise problems concerning analysed quality-wise problem types, one can conclude that: USC-PFA-in, USC FLA, UEC-PFA-in and UTC PFA-in

ID		Description
Problems causes C_i	C_1	Operator's obligation is to maintain permanently a visual contact with UAV/UAS during flight.
	C_2	Although UAV/UAS of category 2 could generally be used in all regions, when needed to fly over people they are essentially unusable in Region IV due to the fact that only UAV/UAS of category 1 can fly over them.
	C_3	UAV/UAS surveying at distances that are less than 500m away from buildings of state/local interest, foreign diplomatic missions as well as significant infrastructure and other facilities, in addition to the usual approvals necessary to get (from CAD, MOD), it is both required to obtain approvals from owners/users of these objects/facilities and to inform local police department(s) about planned activities.
	C_4	In the case of UAV/UAS operating in conditionally prohibited flight zones, after obtaining a positive opinion of relevant authorities (MOD and MOI), the take-off approval(s) is (are) to be issued only (by CAD), whereby the obligation of the applicant is to inform the local police department(s) about planned activities in advance.
	C_5	Single application for take-off approval (by CAD) refers to one flight or series of flights (which may take up to 30 days) allowing the usage of oly one UAV/UAS that can operate on no more than 10 locations.
	C_6	Before starting any post-flight (photogrammetry-wise) processing of the collected data (digital photos/videos), the applicant must submit the recorded material to the MOD experts not later than 8 days after its acquisition (in order to review them and to possibly remove alike any elements of special importance or those that have not been defined in the enclosed proposal of activities and targets to record).
	C_7	To get the airspace allocation, the request should be submitted (to SMA) in cases when the UAV/UAS flights are planned either at an altitude of more than 100m from the ground or near airports/heliports within a radius of 1.5 namely of 5km from ARP (depending on their importance) - regardless of the planned flight height.
	C_8	The use of remote-controlled devices must not endanger the safety of citizens or disturb public order and peace. Accordingly, the operator must ensure that during the flight the horizontal distance of the UAV/UAS from other people is not less than 30m or 5m (if approved by CAD).
	C_9	Restricted time intervals are defined in residential as well as residential-business zones during day- and night-rest periods (both in buildings and their surroundings), when tenants/occupants and third parties (for example various utility services) must behave so as to provide complete silence and peace. The beginning and the duration of those rest periods vary in Serbia from city to city/municipality.

Table 4. Concise formulation of previously localized Pi problems.

quantity-wise problems are prevailing in 4 analysed types (VAG, ABS, TLI, BUR), demonstrating also largely uniform presence of quantity-wise problems among those 4 types ((1,1,1,2), (1,1,1,2), (1,2,1,2), (1,1,1,2); USC-PFA-out, UEC-PFA-out, UEC FLA and UTC FLA problems are 3 of 4 types (ABS, TLI, BUR), characterized also by their fairly uniform presence among those 3 types ((1,1,2), (1,1,2), (1,1,3), (1,1,1)) while UTC PFA-out problems are 2 of 4 types only (ABS, BUR) showing significantly different presence of quantity-wise problems supportive of BUR (2, 9). There are no CON- and INT-type problems. This indicates that bureaucracy issues affect most problems (25). Abundance of problems of VAG, ABS and TLI is quite balanced, while abundance of BUR problems is imbalanced as presence of problems (9) influences out-of-field activities either Pre- and Post-flight regarding unnecessary time-consuming (UTC PFA-out). Note that majority of identified problems are of bureaucracy nature dominantly. With regard to all previously mentioned, the most important conclusion facts are summarized on figure 4.

Notes

1 To present tabularly identified relations between CAT-a elements that cause a concrete Ci without superfluous repetition, while filling-in concrete cells, rows have a priority over columns (filling-in is performed row-by-row regarding the type of influencing CAT-a elements represented by, so that each concrete row-cell is filled-in respecting legislative hierarchy as well (from the "left" to the "right")).

2 Next to the mark of concrete problem cause (Ci), corresponding CAT-a elements affected by are shown in brackets in the form of [X_1, X_2...↔Y_1, Y_2...], where concrete "Xi" refers to article (also paragraph and/or item, if any) of

ID		Formulation	
Problems P_i	$P_{1\text{-}a}$	When CHSs are significantly larger, the operator's obligation to constantly maintain visual contact with UAV/UAS during flight might cause a necessity that he/she permanently change the station points (if possible) and/or to adjust the vehicle's speed to conform with the speed of his/her own movement (regardless of the fact whether activities are pre-planned/programmed or not). That will cause a decrease of EFT by decreasing EFC (of the flight itself) with regard to UTC. Based on the mentioned EFT/EFC consequences, when UAV/UAS is used for surveying, it is absurd to negatively burden the flight realization by respecting the mentioned legislative obligation, especially due to the fact that camera is already present and, among others, used to control the flight.	C_1
	$P_{1\text{-}b}$	In case of reduction of the previously approved flight-date/period (of the requested surveying) due to an appearance of adverse meteorological/other circumstances that make impossible to fly securely or to respect photogrammetric-wise limitations (that refer to proper lighting and shooting conditions that must be satisfied during each uninterrupted in-field photogrammetric activity-phase), to realize planned surveying by achieving EFT declared acceptable at all, it is necessary to increase the number of UAV/UAS (namely, USC and UEC). But, such an increase significantly increases necessary out-of-field activities of administrative nature (one UAV/UAS – one application – one fee).	
	$P_{2\text{-}a}$	Bearing in mind the fact that it is not allowed to have a category 2 UAV/UAS fly over people, when needed to perform surveying in region IV, it is necessary to use a category 1 UAV/UAS. Due to generally poorer vehicle and surveillance equipment performances of such replacement, FLA would increase consequently – causing actually the UTC increase.	C_2
	$P_{2\text{-}b}$	In cases when the problem $P_{2\text{-}a}$ occurs, to maintain the desired level of EFT/EFC of planned surveying, it is necessary to use more than one UAV/UAS of category 1 that consequently generates not only higher UEC, but USC also – together with inevitably arisen out-of-field activities of administrative nature that, in return, induce additional UTC increase (one UAV/UAS – one application – one fee).	
	P_3	Given that CHSs can often be found at distances less than 500m away from buildings of state/local interest, foreign diplomatic missions as well as significant infrastructure and other facilities (having in mind that these objects can also be targets of UAV/UAS surveying activities by themselves), the achieved EFT/EFC of corresponding surveying may consequently be either significantly decreased by means of UTC (namely by means of unnecessary time spent for the formulating, submitting and obtaining of all of the given approvals separately, especially when that is not possible to realize it online) or reduced to zero (in case of rejection by one or more involving authorities).	C_3
	$P_{4\text{-}a}$	When it is needed to fly and/or survey in conditionally prohibited zones, getting permits/approvals (by relevant authorities) is more complex, and often takes longer (especially because of MOI). Accordingly, although requests for their issuing must be submitted not later than 15 days prior to planned flight or series of flights (which may take up to 30 days), it happens more often than not that the approval is obtained immediately before the expiration of the signed date/period. In such case, the overall EFT decreases, because flight(s) can usually be realized incompletely, so as the dominant causing problem actually is the overall EFC decrease (caused by the decrease of UEC and USC from the one side and also UTC from the other side by means of not only time-wasting but time necessary to restart complete out-of-filed procedures of administrative nature from the very beginning).	C_4
	$P_{4\text{-}b}$	In cases a desired UAV/UAS surveying needs to be realized – when approval(s) is (are) obtained just before the end of the required and permitted date/period of flight-time (in situations when it happens more often than not), in order to maintain the initially expected level of EFT/EFC at any cost, the problem of the occurred UTC (by means of unnecessary time-waste) needs to be compensated by the usage of more UAV/UAS.	
	P_5	When various adverse meteorological conditions to take-off and survey safely occur (which happens are more often than not nowadays and are, unfortunately, long-lasting), if needed to realize at any cost the desired one or more locations-surveying in the period approved, it is necessary to use more than one UAV/UAS. Given that one flight-approval application form (issued by CAD) allows only one UAV/UAS to apply so as to operate on no more than 10 locations in a maximal 30-days period of time) in the mentioned case, the described will inevitably affect the overall EFT/EFC by increasing not only UEC and USC but UTC significantly (due to the increase of permission-related bureaucratic procedures which are necessary to initiate for each UAV/UAS separately).	C_5
	P_6	Waiting for the returning of the recorded material (after its controlling by the MOD) disables starting image processing immediately after finishing UAV/UAS surveying activities in CHS, representing, thus, UTC. Such decreasing of the achieved overall EFT/EFC from the aspect of UTC is especially an absurd circumstance in the modern era of digitalization in which software image manipulation is available to everyone.	C_6
	P_7	When CHSs are located within 1.5, namely, 5km away from ARP (depending on importance of airports or heliports), even for flights at altitudes less than 100m, getting the approvals for airspace allocation (by SMA) are also mandatory. But, if meteorological and other circumstances make the permitted UAV/UAS surveying partially or completely impossible (after receiving the allocation), its subsequent realization might also be questionable – but, this time, not only due to the same reasons, but to the fact that previously allocated airspace might be reserved for others. In such case, the overall EFT decreases, because flight(s) could usually be realized incompletely, so that the dominant causing problem actually is the overall EFC decrease (caused by the decrease of UEC and USC on one side and also UTC on the other side (by means of not only time-wasting but time necessary to restart complete out-of-filed procedures of administrative nature from the very beginning).	C_7
	P_8	With regard to an inevitable presence of significant concentration of people and their high movement frequency in limited/narrow public spaces of the Region IV, when legislation is strictly respected, UAV/UAS surveying in that region at altitudes less than those of an average human height, becomes questionable. Namely, in order to provide with certainty that horizontal distance from other people is to be less than 30/5m, it is necessary to increase the number of stuff members (as in-field controllers) and/or to utilize (and to assemble in-field) additional fence/boundary equipment (that, consequently, increases total time of the overall in-field activities). Although, in return, the described steps could disrupt public peace and order in some way, it seems they are inevitable (if REG-1 is strictly respected) besides that their implementation would decrease EFT/EFC of the overall UAV/UAS surveying – regarding USC, UEC and UTC. The said unnecessary resources consumption is a consequence of the vagueness of REG-1 caused by a non-considering the way the mentioned activities should be performed in general so as to be in line with LAW-2 (especially when restrictions of pedestrian movement are not applicable).	C_8
	$P_{9\text{-}a}$	Since the rest period has to be strictly respected, the use of a single UAV/UAS can negatively affect the overall surveying realization (by increasing the total duration of FLA) to the extent that its accomplishing becomes questionable (due to meteorological/other circumstances and the needs to respect photogrammetric-wise directives). When the flight(s) is (are) not realized completely/in one phase, the overall EFT consequently decreases so that the dominant causing problem actually becomes the overall EFC decrease (caused by the increase of UTC – not only by means of time-wasting but time necessary to restart complete out-of-filed procedure of administrative nature).	C_9
	$P_{9\text{-}b}$	When the problem marked as $P_{9\text{-}a}$ is present, and there is a need to realize UAV/UAS surveying at any cost, the solution is to increase the number of UAV/UAS (obviously, if it is reasonable regarding the volume of activities or CHS`s size). Due to the mentioned legislation-wise daily-time limitations, USC and UEC increases together with additional (inevitably arisen) out-of-field activities of administrative nature that refer to the UTC (one UAV/UAS – one application – one fee).	
	P_{10}	When CHS is physically inaccessible for a wide range of reasons so as the operator cannot maintain a permanent visual contact with UAV/UAS, if subject-related legislation is strictly respected, surveying activities cannot be realized. The operator must permanently maintain a visual contact with UAV/UAS during flight while surveying (and, thus, in the mentioned situation too) is an absurd, because the camera is already present on board and used not only to survey but to control the flight in general. To solve this "inaccessibility" problem and, thus, to realize desired UAV/UAS surveying by respecting targeted legislation, it is necessary to use additional equipment (regardless of the fact that this will decrease the overall EFT/EFC due to UEC).	C_1

Table 5. Concise formulation of previously localized Pi problems.
Table 6. Typology of the formulated problems Pi according to EFT/EFC characterization criteria described in the Chapter 4.

Quantity-wise problems-characterization criteria			Quality-wise problems-characterization criteria					
ID			VAG	ABS	CON	INT	TLI	BUR
USC (resources unnecessary used in listed activities)	PFA-out			$P_{1\text{-}b}$			$P_{9\text{-}b}$	$P_{2\text{-}b}$ $P_{4\text{-}b}$
	PFA-in		P_8	$P_{1\text{-}b}$			$P_{9\text{-}b}$	$P_{2\text{-}b}$ $P_{4\text{-}b}$
	FLA		P_8	$P_{1\text{-}b}$			$P_{9\text{-}b}$	$P_{2\text{-}b}$ $P_{4\text{-}b}$
UEC (resources unnecessary used in listed activities)	PFA-out			$P_{1\text{-}b}$			$P_{9\text{-}b}$	$P_{2\text{-}b}$ $P_{4\text{-}b}$
	PFA-in		P_8	$P_{1\text{-}b}$ P_{10}			$P_{9\text{-}b}$	$P_{2\text{-}b}$ $P_{4\text{-}b}$
	FLA			$P_{1\text{-}b}$			$P_{9\text{-}b}$	$P_{2\text{-}a}$ $P_{2\text{-}b}$ $P_{4\text{-}b}$
UTC (resources unnecessary used in listed activities)	PFA-out			$P_{1\text{-}b}$ P_6				$P_{1\text{-}b}$, $P_{2\text{-}b}$, P_3 $P_{4\text{-}a}$, $P_{4\text{-}b}$, P_5 P_6, P_7, $P_{9\text{-}b}$
	PFA-in		P_8	$P_{1\text{-}b}$			$P_{9\text{-}b}$	$P_{2\text{-}b}$ $P_{4\text{-}b}$
	FLA			$P_{1\text{-}a}$			$P_{9\text{-}a}$	$P_{2\text{-}a}$

ID	CAT-b elements of interest		
Identified problems P_i	PFA-out	PFA-in	FLA
$P_{1\text{-}a}$			One-time impact
$P_{1\text{-}b}$	Four-times impact	Three-times impact	Two-times impact
$P_{2\text{-}a}$			Two-times impact
$P_{2\text{-}b}$	Three-times impact	Three-times impact	Two-times impact
P_3	One-time impact		
$P_{4\text{-}a}$	One-time impact		
$P_{4\text{-}b}$	Three-times impact	Three-times impact	Two-times impact
P_5	One-time impact		
P_6	Two-times impact		
P_7	One-time impact		
P_8		Three-times impact	One-time impact
$P_{9\text{-}a}$			One-time impact
$P_{9\text{-}b}$	Three-times impact	Three-times impact	Two-times impact
P_{10}		One-time impact	

Table 7. Occasioned relations between analysed CAT-b elements and problems Pi identified in CAT-a hierarchy.

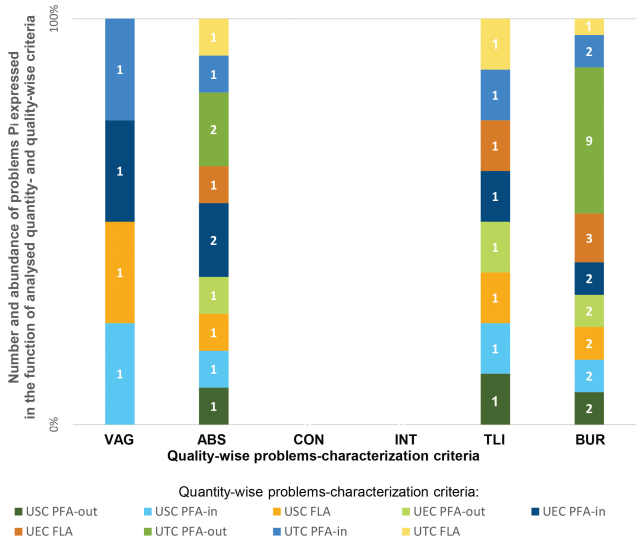

Chart 1. Number and abundance of problems Pi expressed in the function of analysed quantity- and quality-wise problems-characterization criteria.

corresponding law/bylaw which is listed in the left-positioned table-header, while a concrete "Yi" refers to an article (also paragraph and/or item, if any) of corresponding law/bylaw listed in top-positioned table-header). Mark "↔" represents identified relations between articles (also paragraph and/or items, if any) of corresponding CAT-a elements (laws and/or bylaws).

Acknowledgment

This investigation is performed at the University of Belgrade - Faculty of Architecture, within the "Laboratory for Research, Valorisation, Conservation and Presentation of Cultural Heritage", founded and financed by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

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Figure 4. Summary of the most important conclusion facts.

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