Municipal Sustainable Coastal Governance: Participatory Approaches for System Analysis and for Local Monitoring Development

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Abstract: Within the EU BONUS BaltCoast project there were analysed as integrated coastal management (ICM) recognized case studies in Latvia and other Baltic sea region countries, applying System Analysis Framework (SAF) methodology, being based on socio-ecological systems (SES) studies approach complemented by local stakeholder's involvement and related participatory ICM decision-making. Most of former ICM practice cases available have been different from both mentioned SAF approaches, but in many cases there were recognizable most known traditional ICM elements. General problems found were related to the following limitations - ICM project/problem team establishment and working practice as multi-disciplinary and SES oriented, stakeholder full scale and whole problem-solving period participatory forums/media and communications, limited/formal participation, mainly top-down and not bottom-up approaches used with often lacking collaboration elements and, particularly, coastal communication etc. Afterwards, SAF designed local case studies in the 6 partner countries were established and research-and-development projects started in cooperation with local municipalities and other stakeholders. In Latvia, taking into account mentioned ICM cases deficiencies and previously known limitations of ICM understanding and capacities building, Salacgriva rural municipality coastal governance case has been under SAF application development via selected Collaborative governance scenario, which is to be elaborated and tested, applying into municipal governance practice ICM Interface module, previously studied and designed by national research program project SUSTINNO, namely developing complementary set of incremental governance cycle instruments. All proposed instruments could be considered as national/local innovations: Coastal SES status and governance thematic report (Coastal Outlook); Collaborative municipal coastal monitoring programme, incl. particularly citizen science application (Coastal monitoring); Coastal indicators system (CIS); Coastal spatial planning proposal. Finally, mentioned voluntary municipal ICM instruments are to be integrated into mandatory municipal development planning system and documents, particularly, Spatial development plan. The main objective of the paper is to demonstrate transfer from coastal research/data to practical instruments development and establishment for local coastal governance, and, in this paper, we were focusing on the development of coastal monitoring program and indicators system, both with citizens' science components.

Keywords: coastal governance, collaboration governance scenario, interface, coastal monitoring, indicators

1 Introduction

During EU BONUS BaltCoast project realization since spring 2015, the System Analysis Framework (SAF) based conceptual system model for Salacgriva municipality coastal governance case in Latvia has been finalised and Latvia University project team efforts were concentrated towards main further work directions - four coastal governance scenarios evaluations and, subsequently, selected collaborative governance scenario implementation start-up by drafting ICM Interface module application for EU BONUS BaltCoast project, including related complementary set of local level ICM instruments, being previously studied and designed by national research program project SUSTINNO. Initially, the experience of SAF basically relates to the reflection of socio-ecological systems (SES) development scenarios, thus there was proposed step-by-step approach for the adaptation of SAF methodology for SES governance scenarios. The conceptual definition of the Social-Ecological System is based on the sustainable

development approach, which proposes that coastal systems are based on interconnected elements of the complex resources system consisting of natural, cultural, socio-economic, and governance resources (systems). Thus, the concept of four systems served as a basis for the model development.

Related to SAF approach, there was prepared conceptual approach for governance scenarios definition and structuring within SAF application. There were defined four internationally known governance development scenarios into their application for particular coastal territory: (1) Business-as-usual governance scenario, (2) Top-down governance scenario, where ICM is to be in very detail integrated into general municipal management structure, (3) Bottom-up governance scenario, where for ICM development local coastal stakeholders are taking definitive and established role. Field studies on coastal governance processes and instruments were done and, even Salacgriva municipality have non-traditionally widely developed number of elements for both last governance approaches, finally discussion had come to the conclusion, that the (4) Collaborative governance scenario (CGS) shall be appropriate scenario for adaptive coastal governance of long coastline and limited administrative capacities rural municipalities, and, useful elements of previous scenarios shall be incorporated as far as possible.

Based on the system model, designed and developed within the SAF, there were elaborated requirements, incl. stakeholder participation process, for contentual elaboration of Collaborative governance scenario into governance practice by designing of ICM interface, namely, developing complementary set of incremental governance cycle instruments. All proposed instruments could be considered as local innovations: Coastal SES status and governance thematic report (Coastal Outlook); Collaborative municipal monitoring programme, incl. citizen science application (Coastal monitoring); Coastal indicators system; Coastal spatial planning proposal. Mentioned voluntary ICM instruments are to be integrated into mandatory municipal development planning system and documents, particularly, Spatial development plan.

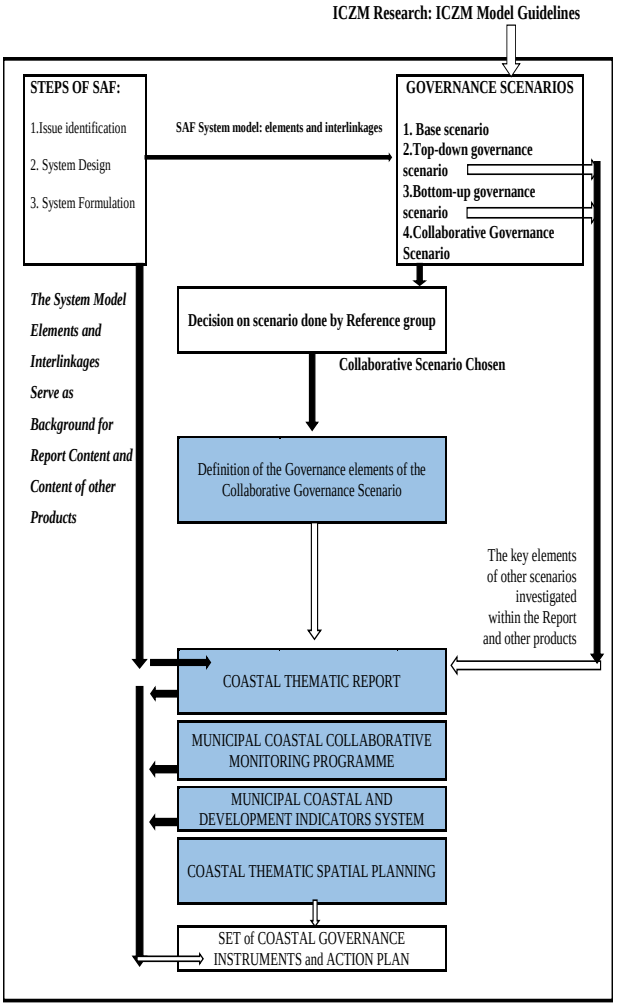
Coastal Outlook proposal preparation started with system dynamics modelling step, performing first system model tests as for traditional SAF application, and, presenting system model in STELLA language. System model structure were built including extensive list (~ 40) of SES parameters, collecting necessary complete data set, to present the possible development trends. Several parameters characterising also climate change impact were selected as an actors influencing coastal processes and they are – number of biologically active days, number of strong wind annual cases, precipitation extreme cases and coastal erosion. For each of these parameters necessary studies were done and the mathematical trend, based on long-term past data, has been calculated. Besides also the coastal tourism development trend was particularly investigated and modelling results obtained. The sensitivity analysis for the model was performed. The tourism development trend was chosen and tested as most interesting trend for stakeholders.

Municipal coastal monitoring programme proposal preparation started based on Coastal Outlook content draft and related field studies performed. Field studies finished to monitor coastal erosion and to evaluate also possible public involvement as to develop public monitoring programme proposal (citizen science approach). Similar approach has been applied and field studies (incl. also beach visitor's questionnaire), according to internationally accepted monitoring programme, have been finished on beach litter public monitoring practice and its methodology further development. First draft proposal for coastal public monitoring activities at the local governance level has been prepared, and, further work is ongoing in order to design and discuss with stakeholders first version of whole municipal coastal monitoring programme (mandatory including of citizen science approach) as ICM instrument. Coastal indicator system proposal is also elaborated and complementary part of monitoring program.

2 Problem Formulation

It has been developed the coastal system dynamic model (hereinafter - SDM) for generalized rural coastal territory in Latvia, having around 500 km coastline, mainly sandy beaches, also mainly governed by rural municipalities. The SDM has allowed to establish the optimum number parameters set (necessary and sufficient) to characterize the state of the coast in rural coastal municipalities. Continuing analysis of the SDM have allowed (i) to understand in details the on-going natural (ecological) and socio-economic processes in the typical Latvia coastal areas and their interaction, as well as (ii) to understand the necessary framework for the interface to link science - governance decision making.

As presented in our previous publications, we have developed the systemic application – ICM Interface module - how to transfer the academic knowledge to practical tools for coastal governance. We propose, these tools should be: (1) Coastal Governance Thematic Report, (2) Municipal Collaborative/Public Coastal Monitoring Program, (3) System of Coastal Sustainability Indicators, (4) Coastal Thematic Spatial Planning. In this paper we will focus on the development of the municipal coastal monitoring program and the citizens' science component of it as well as municipal coastal indicators system. The main objective of the paper is to demonstrate this still lacking transfer from the mostly research (as the development, modelling and analysis of SDM) to practical improvement of the coastal governance. Important to underline, the system elements and linkages of the SDM (research phase) serve as the inputs for the formulation of these tools (implementation phase), and all the noted tools are based on and contain the clearly visible quantified numerical information.



3 Problem Solution Development

Now let's look for mentioned problem solution developments via first selection of ICM instruments as ICM Interface module elements, being based on Coastal system dynamic model developed and tested.

3.1 Coastal System Dynamic Model

Firstly, we have look on the systemic parameters forming the SDM. In the Table 1 it is presented the list of these parameters which is understand as the input parameters set defining initial conditions for the further analysis of the state of the coast. At first, the parameters have been analyzed from the point of their dynamic for the change, namely, all the parameters have been grouped into two principal groups: statistical parameters (low dynamic of change) and dynamical parameters (high dynamics of perspective change). The parameters having significant dynamics for change have been further included in the list of the coastal sustainability indicators. As seen in Table 1, we also marked important parameters for the IS, however inclusion of them is not currently possible due to lack of reliable methodology and data which shall be developed in future.

Table 1. Using of SDM parameters in indicator system (IS) of coastal sustainability.

No	Parameter	Included in IS	Case if not included; other notes
1	Natural monuments	No	Static parameter, it is necessary parameter applicable for the modelling exercise and comparison of different territories
2	Marine litter	Yes	Public monitoring.
3	Volume of primary dune, class	Yes	Professional measurements required, partially public monitoring might be done, if appropriate training performed before.
4	Volume of seashore silt, class	Yes	Professional measurements required, partially public monitoring[1] might be done, if appropriate training

			performed before
5	Rescue service arrival time	No	Set by regulation, necessary parameter applicable for modelling exercise
6	Natural resources	No	Extraction of mineral resources is prohibited at coastal protection zone. Presence fact is used in the modelling exercise.
7	Number of strong wind cases	Indirectly	In the IS it is expressed through parameter with the more practical value (financial effects through insurance events)
8	Number of biologically active days with average air temperature over 10ºC	Yes	Based on one spatial measurement point: meteorological station in Ainazi.
9	Precipitation extremes as 75th percentile exceedances	Yes	Based on one spatial measurement point: meteorological station in Ainazi.
10	Forestry: cut-off amount as glades	No	Cut-offs are prohibited at coastal protection zone. Presence fact is used in modelling exercise.
11	Biodiverse areas (conservancy areas)	Yes, adjusted	Altered dynamic parameter. Expressed through area.
12	Degraded territories	Yes, adjusted	Altered dynamic parameter. Expressed through area.
13	Traffic flow	Yes, adjusted	In the IS it applies to the country's main road (highway A1 Riga-Tallinn), see Fig.1 below
14	Collected waste: sorted/non-sorted	Yes, Modified	In the SDM it describes the overall situation in the municipality. In the IS it is replaced with collecting/sorting infrastructure at coastal zone.
15	Air pollution sources	Yes, Modified	Public monitoring method used in the IS
16	Ecosystem services, variety	No	Low dynamic parameter
17	Number of visitors	No	Can be valuable for IS. However high costs and human resources to obtain direct reliable data required. Public monitoring cannot be applicable here, as need very regular systematic measurements. In the modelling exercise value is determined indirectly based on other related data sources (the approach cannot be used in definition of the value in the IS).
18	Wastewater amount	No	In the SDM it describes the overall situation in the municipality and thus does not describe the coast. However, the state statistics does not include diffuse wastewater sources. Inclusion in the IS needs detailed elaboration of the methodology, it can be done in future
19	Noise pollution	No	In the modelling exercise the values are based on experts' judgements. No publicly available and systematic quantitative data allowing to include in the IS.
20, 21	Number of households Individual heating systems	No	In the SDM it describes the overall situation in the municipality. Inclusion in the IS needs performing of

			local census as data obtaining method
22	Birth rate	Yes. Modified	Included as natural growth.
23	Income rate	No	In the SDM it describes the overall situation in the municipality. Inclusion in the IS needs performing of local census as data obtaining method
24	Migration rate, saldo	Yes	For overall municipality; coastal zone is not separable.
25	Health indicator	No	Semi- quantitative parameter, In the modelling exercise the values are based on experts' judgements derived from international methodologies for scaled qualitative evaluation. Not available in municipal cross-section.
26	Share of higher education	Yes	Measurements only in *census*.
27	Lifelong learning	No	Can be valuable indicator to evaluate capacity of local human resources, Inclusion in IS might be done after elaborating the detailed well-grounded definitions and methodology, including the methodics for obtaining reliable quantitative data.
28	Education level	Indirectly	Direct quantitative data on education level are not available. National *Census* gives data on relative share (%) of inhabitants with certain finished level of education. The appropriate methodology thus should be developed how to extract necessary appropriate format quantitative data from the *Census*. On the other hand, the last *Census* provides high spatial distribution per km2. Decision is to use in the IS the No26 above "Share of higher education". In the modelling exercise the values are based on experts judgements
29	Nature objects, biotopes	Yes. Modified	Altered-dynamic parameter. Expressed through area.
30	Fishing boats	Yes	Registered fishing boats only.
31	Visual change quality	No	In the SDM it is the aggregated indicator, summed by input of the several another parameter. In such sense it is not a quantitative parameter, not usable as indicator by definition.
32	Dredge works	No	Too specific, decision not to include in the IS
33	Financial resources indicator	No	Currently data not available to include in the IS. Inclusion needs establishment of coastal financial data reporting system in the municipality.
34	Agricultural land	No	Spatial resolution for accessible data have unsatisfied resolution for municipal scale. Approximations had been done to apply it in the modelling exercise.
35	River (Salaca) ecological	Yes, Modified	In the IS it replaced with small river water quality

	quality indicator		assessment by public monitoring method.
36	Number of mobile WC	Yes, adjusted	All WC included, not only mobile.
37	Equipped sites	Yes	The definition, adjusted consulting municipal authorities and stakeholders.
38	Tourist trails	Yes, Modified	Included as total length of equipped trails.
39	Tourism centers	No	Non-dynamical parameter; one center is enough for district area. Presence fact is used in modelling.
40	Bathing water quality	Yes, Modified	Included as percent of correspondence by guided and mandatory values.

3.2 Coastal Indicators System

Coastal Indicators System (CIS) is designed for supervision of coastal long-term planning documents. With minimal transformations the system can be adapted for other coastal municipalities of Latvia. Hereby we present the outline of application of CIS to Salacgriva municipality (see. Table 2 for full information).

The transforming of the SDM to CIS was done based on the following principles: (1) evaluating the dynamism of SDM parameters and including in the CIS those parameters with sufficient dynamics; (2) evaluating regular, reliable and on coastal area applicable data obtaining opportunities from publicly available data sources or by applying other direct methods for data obtaining, incl. citizen science; (3) including indicators which provide a link with the Salacgriva municipality long-term sustainable development strategy (SDS) till 2030 and mid-term municipal development programme; (4) evaluating necessity of additional indicators to characterize the coastal natural- socio economical system in the more detailed manner based on the capitals of sustainable development.

CIS is structured firstly by main components of sustainability (nature, economics, social environment, governance, integral indicators). Each indicator included in the CIS has passed review on its disciplinary area of expertise. The following disciplinary parts are included in the CIS: (1) coastal nature and environmental quality, (2) coastal economics, (3) coastal lifestyle.

The second structural level is composed of strategical goals and their components, which are stated in Salacgriva municipality SDS till 2030, thereby coastal sustainability assessment horizontally integrating with municipal planning long-term guidelines has been provided.

The interlinkage of different parts of CIS to reflect interdisciplinary character of coastal area has been done by introducing the part of integral indicators. The CIS as a whole complex system thus describes state of the coastal area, stability of both coastal ecosystem and coastal socio-economic system, and their restorative potential and participatory functions. Regarding the participatory function, the CIS presents the main stakeholder concerns through the key parameters of the coastal state which can be improved within the collaborative governance scenario by stakeholders participation. Thus, the developed CIS represents the coastal system as closely as possible and can produce reasonable view on coastal and coastal governance state and dynamics taking into account known defined limitations and conditions. This reasonability is provided both by the chosen structure of the CIS and the chosen data collection & processing, and analysis methods.

Depending from content and substance of the indicator and features of input data spatial distribution, each indicator has defined territory, which in the case of particular indicator is called as the coastal area. Such defined coastal areas are: beach, coastal dune protection zone, coastal protection zone, notional territory (mainly among highway A1 and the Riga gulf). Simultaneously, some of sustainability dimensional indicators and all integral indicators are attributed to the all municipality. Such approach is justifiable, because: (i) in the vast spatial coverage (regional, state, international) all Salacgriva municipality belongs to the coastal territory, (ii) changes of concrete indicators in all territory of the municipality reflect also coastal sustainability, despite the fact, that the last is not spatially separable from all municipality sustainability.

Regarding the application area of the CIS, all three areas below are valid: (1) the CIS relates to public policy, (2) the CIS relates to the occurrence of natural events and long-term change of them, represented by including the indicators characterising the climate change, (3) the CIS relates to the interactions between nature and the society – the stakeholders may identify the impact of the increase of a specific type of human activity through the overall change of the state in the coastal area.

The CIS and the related municipal coastal monitoring programme operation is based on: (1) modifying and better use of existing component, namely, better application of existing municipal executive institutions capacities, (2) adding new component, namely, opening space for new bottom-up stakeholders initiatives and organizing them in common package, (3) involving this new component and optimising existing component will lead to establishment of new approach for assessment of coastal area and new governance decisions based on it.

The appliance of CIS has been evaluated also on the basis of the general governance scenarios. Namely, it was established: (a) what data and for what indicators are collected for the time being (BAU scenario), (b) what additional data might be collected by municipal executive institutions/services (top-down approach), (c) in which data collections the stakeholders are motivated (bottom-up approach), (d) what collaboration shall be established between municipal authorities and stakeholders activities and what new added value it gives (collaborative scenario).

Table 2. Coastal sustainable development governance indicators for Salacgriva municipality

Nr.	Referable development goal by Salacgriva district SDS	Indicator/parameter	Target value 2030 or trend	Data source
1	Spatial and functional assurance of coastal accessibility	The total length of tracks in the dune area, km	[increases]	Municipality Council (MC)
2		Exit points at the sea, which are fixed in nature, % from indicated in SP	100	MC, Public monitoring (PM)
3		Exit points at the sea, which are suitable for disabled people, % from all the real	100	MC, PM
4	Climate change and adaptation to the reinforced natural risks	Biologically active days per year (with average temperature above +10ºC)	declaratory	Latvian Environmental, Geology and Meteorology Center (LEGMC)
5		Volume of primary dune, class	declaratory	Measurements
6		Volume of seashore silt, class	declaratory	Measurements
7		Precipitation extremes as 75th percentile exceedances	declaratory	LEGMC
8	Risks reduction caused by transport flows and related to it	Illegal motor vehicle entrance in the dune zone, cases per year	[decreases]	MC, PM
9	Planning and creation of coastal environmental infrastructure	The number of public toilets in the dune zone or in the vicinity	[optimal][a]	MC, state Health Inspectorate (HI), Regional Environmental Boards (REB)
10	*Coastal environmental quality (in the SDS targets indirectly)*	Marine litter, number of items	[decreases]	PM: project "My sea"
11		Bathing water quality, % of the guided and mandatory values	90 and 100	HI
12		Biodiverse areas (conservancy areas)	[not decreases]	REB
13		Degraded areas	Tends to 0	MC, PM

Nr.	Referable development goal by Salacgriva district SDS	Indicator/parameter	Target value 2030 or trend	Data source
14		Valuable biotopes	[not decreases]	PM
15		Small river ecological quality by bioindication	[improving]	PM
16		Air quality by lichenoindication	[no worsening]	PM
18	Planning and creation of coastal functional infrastructure	Parking capacity in the dune zone vicinity, places	[optimal][a]	MC
19		Specialized sport and recreation zones on the beach, % from official beaches	50	MC
20		Equipt sites	[increases]	MC, PM
21		Number of waste containers and bins	[increases]	PM
22	Support of marinas, yacht hosting and maintenance services	Yacht and boat piers number	[increases]	Port, owners
23		Adopted yachts and boats per year	[increases]	Port, owners
24	Cargo ports and their infrastructure development	Adopted number of vessels and their total GRT per year	[optimal][c]	Port
25		The cargo turnover, thsd. t per year	[optimal][c]	Port
26	Recreational trips at sea on the regular tourist routes	Available route number	>=3	Port
27		The number of passengers per year	[increases]	Port
28	Adaptation to the natural risks reinforced by climate changes	By organic farming method operated agricultural land proportion, %	[increases]	Rural Support Service
29		The number and amount of trend of insurance cases for natural disasters	[stable or decreases]	Insurers
30	Risks reduction caused by transport flows and related to it	Number of parking places for cars and trailers	[optimal][a]	MC
31		The main traffic flow	declaratory	Latvian State Roads
32	Creation of green communal services and energy independence	Energy consumption from own (renewable and alternative) energy resources in communal services, % from total	100	MC
33		Accessability of water management services in towns and villages, % from of households	95	MC
34		Number of registered fishing boats	[not decreases]	Sea Administration
35	Collaborative governance	Village elders existance in villages, % from number	100	MC

Nr.	Referable development goal by Salacgriva district SDS	Indicator/parameter	Target value 2030 or trend	Data source
	development by deepening of social partners involvement	of villages		
36		Supported NGO driven projects number and total financing, thsd. EUR	[increases]	NGO Union „Jūrkante"
37	Environmentally friendly governance instruments development	Inhabitants satisfaction with the coastal governance, % of positive satisfaction groups	>80	PM: survey
38	*In the SDS targets indirectly*	Traditional craftsmen, number	[increases]	MC
39		Share of higher education	[increases]	national Central Statictical Bureau (CSB) *census*
40	*Not in SDS targets and SDM*	Coastal residents inhabitant part, % from all	[stable]	CSB *census*
41	Integral parameter of the overarching objective: general development	Index rank of territorial development level	[increases]	State Regional Development Agency (SRDA)
42		Index change rank of territorial development level	[on the increase]	SRDA
43	Integral parameter of the overarching objective: demography	Population in towns and parishes of the municipality	[increases]	CSB
44		Natural growth of population in	>0	CSB
		the municipality		
45		Migration balance	>0	CSB
46		The age composition of the population by main groups	[increases youth groups]	CSB
47	Integral parameter of the overarching objective: budget	PIT in the municipality budget, EUR/inh.	[increases]	State Treasury
48		Tax revenue share in the budget, %	[increases]	State Treasury
49		Overall budget, thsd. EUR, equated to purchasing power in the base year	[increases]	State Treasury
50	Integral parameter of the overarching objective: economics	Economically active statistical units, number	[increases]	CSB
51		The number of employees in enterprises with the number of employees 50 and more	[increases]	CSB
52		Proportion of working in public and private sector, %	[increases priv.sect.]	CSB
53	Integral parameter of the overarching objective: governance	Inhabitants satisfaction with governance, % of positive satisfaction in groups	>80	PM: survey
54	Integral parameter of the overarc	Unemployment level, % from working age	optimum 4 – 4,5	State Employment Agency

Nr.	Referable development goal by Salacgriva district SDS	Indicator/parameter	Target value 2030 or trend	Data source
	hing	inhabitants		(SEA)
55	objective: social exclusion (relatively as the reciprocal of cocial welfare)	Long-term unemployment, % from registered job seekers	<1	SEA
56		Powerty risk index, % of inhabitants	<5	CSB

3.3 Municipal Coastal Monitoring Program: temporal levels selection

The CIS is the principal tool for the improvement of coastal governance practice. At the same time the application of the CIS is sensitive regarding availability of resources to implement it – costs, human resources, time, as well as others. Sensitivity analysis shows that the different levels shall be used:

(1) strategic level – application of the full CIS. The measurements shall be done each 2 years for very dynamic indicators and 5+ years for the indicators with lower dynamic. The main obstacles for implementing the full scale CIS is high requirements for costs and human resources (compared to the existing availability of them in rural coastal municipality). Thus, the implementation of full scale CIS should be understood as the medium/long term objective.

(2) thus, in the short term period the tactical level of coastal monitoring shall be implemented. Its means monitoring of indicators, highly relevant for characterization of change in the coastal area – it should be monitored the minimal required set of indicators to identify in due time the changes in the coastal area. Important, the measurements of them might be done at reasonable costs and by both municipal specialist and local communities (citizens science) efforts. At the noted tactical level, the selected indicators should be measured each year. Important, the tactical level monitoring shall be done in close relation with the actual development targets of the municipality,

(3) the operative level means the observation of the processes within critical coastal areas, which should/might be done seasonally or even each month, if critical influence might be expected. Both municipal specialists and local coastal inhabitants should be included in the programme of the observation; the obtained data should be quickly processed and analyzed, and based on it, the operative coastal management/governance decisions should be decided and implemented in due time.

Thus, the municipal coastal monitoring system consists from three levels:
(1) development indicators system for long-term observations (presented in Table 2).
(2) development medium-term indicators monitoring (not presented in current paper)
(3) development short-term indicators monitoring (presented in Table 3)

Table 3. Municipal short term action plan monitoring indicators for coastal development

Position in action or investment plan	Measure or parameter to be monitored	Measured unit
United, active, socially secured and intelligent society		
VTP1.1. Effective governance	Participation of council staff in professional development events	number
	Inhabitants satisfaction with governance	% of positive satisfaction in inhabitants groups
	Cooperation projects with other coastal municipalities in Latvia and abroad	number
	Developed new municipality spatial plan	taken decision about approval
	Resources spent in support programs	EUR
VTP 1.2. Diverse education	Established professional education program	marking on fact
	Increased qualification of education, culture and sport specialists of municipality	number
	Resources spent in support programs	EUR

VTP1.3. Cultural environment	Resources spent in support programs	EUR
VTP1.4. Physically active and healthy lifestyle	Summer and winter sports equipment available for rental	marking on fact
	Resources spent in support programs	EUR
VTP 1.5. Accessible healthcare and social services	Resources spent in support programs	EUR
SM2 Successful business environment		
IP2.1. Qualitative municipal services and support measures for entrepreneurs and investors	Resources spent in support programs	EUR
SM3 Structured, safe and available infrastructure		
VTP 3.1. Qualitative living environment	Ensured public and operative transport access to the sea	marking on fact
	Resources spent in support programs	EUR
VTP 3.2. Qualitative infrastructure	Performed reconstruction and building of water supply and sewerage system of Svetciems, Tuja, Jelgavkrasti villages, Salacgriva and Ainazi towns	EUR; marking about completing of planned
	Renewed street and road coverage, constructed rain water sewerage systems, installed hydrants for fire protection	EUR; marking about completing of planned
	Designed and built local and international importance cycling-infrastructure	EUR; marking about completing of planned
	Installed bicycle stands and sheds near municipality institutions, as well as important tourism objects	Marking about completing of planned
	Reconstructed stage of Fishermen (recreational) park	Marking about completing of planned
	Renovated and /or saved cultural historical objects	EUR; marking about completing of planned
	Established parking places (near roads in the vicinity of sea)	Marking about completing of planned
	Resources spent in support programs	EUR
VTP 3.3. Energy effective and sustainable management	Resources spent in support programs	EUR
VTP 3.4. Extension of port territory, deepening of waterways	Structured documentation of Ainazi port territory	Marking about executing fact
	Resources attracted and spent in support programs	EUR
SM4 Recognizable tourist region		
VTP 4.1. Structured tourism infrastructure	Established new Salacgriva municipality symbol and image, which characterizes Salacgriva municipality	Marking about executing fact
	Reconstructed Tuja pier	EUR; marking about executing fact
	Performed conservation of old Ainazi lighthouse, improved visual look, safety	EUR; marking about executing fact
	Reconstructed Ainazi pier	EUR; marking about executing fact
	Resources spent in support programs	EUR

3.4 Public Monitoring Program Outline (citizens' science approach)

In discussions with experts a set of perspective Monitoring activities, having real application for local municipality in planning and execution of coastal zone management/governance, were established. They include following proposals:

1. Photo documentation of coastal processes. Includes fixation of the state of the following factors: (a) border zone between wave and dune zone, (b) erosion intensity, (c) dweller and

visitor exits to the coast and their onsite impact as well quality assessment. The given Program has high possibility to fill the "information gaps" of the small scale trends, as seen by even single family, living on the cost. As specific activity can be looked collection of old photographs from family Photo albums and then trying locate the spot and repeat the photography, catching the trends.

2. Monitor of the state and trends of coastal dune fortifications. Photo fixation can reveal even small scale trends.

3. Coastal accumulation/ erosion areas. Program is important for local Municipality to assess real trends and need of potential investments to safeguard and maintain coastal infrastructure from accumulation and erosion processes. On other hand, Program is expensive due to necessity to establish precise and durable reference points, as well necessity to involve qualitative expert, who is able interpret the monitored changes.

4. Locations of Washed ashore algae for assessment of as Beach quality and their further management. Results of the given problem can be interesting for the Municipality due to complaints on beach quality.

5. Distribution of invasive species in terrestrial part of the dunes. Two species – Japaneese Rose *Rosa rugosa* and Sea –bucktorn *Hippophae rhamnoides* are concerned as species both depressing living conditions for local species and promoting decrease of coastal biological diversity, as well due to their physical implications to make wounds, induced by their thorns for coastal visitors4. Thus in case of distribution of these invasive species a wide area might become step-by-step not-attractive for tourism activities consequently decreasing also economic activity in the near coastal area and decreasing the multiple uses of the coastal area.

6. Monitoring of wintering aquatic birds. Program can be developed in close cooperation with Latvian Ornithological Society and Nature Conservation Agency Vidzeme Regional Administration. Results can be useful for Tourism attraction and installment of informative boards. The importance shall be paid to establish more linkage of this monitoring results to the coastal area planning.

4 Conclusion

In the Latvian context, it appeared to be essential to find ways how to organize coastal governance (the governance process, content and structure) in the coastal rural territories, which are characterized by a small number of residents and low population density, band a long coastline. It principally affects the way how a territory and its resources shall be managed and governed. In most of the rural coastal territories in Latvia local coastal governance is comparatively underdeveloped and limited, what results in unsustainable use of the coastal resources, thus preventing local development and causing coastal degradation which remains a threat to sustainability of the resources.

However, limited capacity of the coastal municipalities' administrations (in terms of human resources and economic options) considerably affects the traditional "top-down" approach of the municipal governance realization as well as its efficiency. The solution should be found in further development of the "bottom-up" governance models by strengthening the interaction of the "top-down" and "bottom-up" governance, i.e. collaboration in the governance development. The needs of the local coastal citizens interact with the needs of visitors and the wider society. Actually, it is necessary to find a balance between these needs. System Thinking and the application of System Approach Framework (SAF) are tools that allow passing sequentially through various stages of the system analysis, thus arriving at the common denominator in the coast and coastal resources governance acceptable for all involved stakeholders.

The SAF application is an innovative task, especially for the governance systems. Based on the general approach of the SAF, the authors applied in the case analysis a specifically designed step-wise approach seeking to develop the coastal resource governance system. The problem analysis performed by the authors demonstrates application of the problem analysis methodology in a situation which is typical for Latvian rural coastal territories – there are not severely dominating problems in the majority of these territories, but there is relatively high amount of small problems which with important mutual synergy influence cause a multiplier effect. Finally, the authors arrived at the generic problems the solutions to which should be found focusing on the coastal governance system.

ICM requested coastal nature-social science results interaction needed is to be transformed into local level science-policy-practice chain governance, and that could be done as particular interface process and content development, being based on structural design of to be elaborated/tested local municipal coastal monitoring system (incl. citizen science approach) as part of local municipal development governance.

In overall, the application of SAF methodology and adaptation of it to the specific

coastal governance research case in Latvian pilot study site at the Salacgriva municipality allowed:

1. novel application of the SAF methodology;
2. building of a new collaborative governance model and design its essential tools;
3. to create an interface between science, policy (decision making) and practice (society);
4. to conceptualize coastal monitoring program as an essential tool for collaborative governance that is aimed at improved ICM and is based on local ownership and active public engagement.

Policy initiative offering innovative approach for science-policy-practice mutual cooperation module or interface for municipal ICM implementation**:**

(1) local municipal coastal monitoring system, based in the participation of society target and interest groups,

(2) coastal governance thematical survey, unifying coastal situation and coastal governance situation analysis/assessment,

(3) coastal and development indicator system, applicable for the municipal level (system content) and its practical use in the coastal governance planning (system application process).

By this it is offered the comparatively innovative approach for science-policy interface within municipal ICM based on local municipal coastal monitoring and coastal indicators systems and on substantiated data/information of natural sciences as well of social sciences and having important part of citizens science. As far as possible, the necessary socio economic research within the particular coastal area/municipality shall be designed and done jointly with national research programs/international research projects, but allowing space for national and local coastal area specifications and traditions.

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