Digital Transformation - An Extended Future Outlook for the Balkans Region

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Abstract: The article presents a study framework for mixed human-machine future analysis and an assessment of the plausible effects of the digital transformation towards the year 2030 in the Balkans region. An experimental framework for foresight analytical exploration of key driving factors, ambiguities, transcedents* and perspectives towards the near future is outlined and explored. The approach gives a comprehensive outlook for the future transformational expectations taking into account regional specificities. Finally, a concluding discussion on the presented findings and uncertainties is also given.
Keywords: foresight mixed analysis, digital transformation, digital transcedents, human-machine joint assessment, Balkans region

INTRODUCTION

Successfully understanding the digital transformation's future effects is a challenging task at a regional level, especially in the Balkans, where there is a need to reconcile the Balkans multicultural, multiethnic and historical peculiarities with the sustained need for progressive socio-economic development. In this sense, it is important to note that similar comprehensive models but from broader security perspectives are also available for the next ten years *[Minchev & Bogdanoski, 2018, Shalamanov, 2020, Tagarev, 2020]*. A more global outlook towards the transceding socio-technological effects of the digital transformation has been recently noted in Minchev et al. (2019). The novelty of the present study is the obvious clash of digital technologies driving this acceleration, mainly addressing indirect human needs twined with the primary need for survival, tested by the present pandemic and by external drivers such as climate change. Assuming that the new COVID-19 pandemic is going to have a more significant influence than was initially expected, several recent studies can provide alternate perspectives from a transformational viewpoint *[Minchev, 2020, COVID-19 WEF, 2020, Chen et al., 2020, COVID-19 EU, 2020]*.

Apart from this issue, the global economic shrinkage and the contradictory forecasts are naturally producing a negative strategic effect on the region's development, together with the recent tensions between some of the neighboring countries *[Adar, 2020, Turkey EC, 2020]*. The positive lining to the situation are various infrastructure efforts, addressing joint transport, communication and, at a later date, energy and ecological policies

* The word "transcedents" is used to express something beyond challenges, opportunities, etc.

for the region (see e.g. New Balkans Vision 2030 (2020), Okano-Heijmans, 2018).

An expectation for a growing level of digital culture, media freedom, literacy, education and skills, and for the progressive implementation of modern technologies is naturally assumed.

However, the joint human-machine symbiotic handling of the future society transformation processes towards establishing a new smart living and governance environment, either in an accelerated or somewhat delayed manner, for a new resilience and progressive changes becomes a distant prospect under today's constraints.

The more plausible assumptions concern new regional integration levels, social divisions on different bases (e.g. religious, economic, ethnic) and new technological threshold in weapon systems or coercion systems (mainly for border security and for bypassing privacy restrictions), among other such developments.

Thus, what will really happen for the next ten years is quite uncertain and requires an adequate and profound exploration framework, that will be further presented in this paper.

METHODOLOGICAL APPROACH

The present study framework is actually extending the ideas from Minchev (2020) by adding the joint human-machine factor in the assessment processes, trying to accelerate and at the same time demystify the foresight process. The process is divided into three stages: (i) Scenario Landscape Definition; (ii) Analytical Risk Modelling; (iii) Results Assessment.

More details on the practical application of this framework will be further given, adding a concrete illustration for the Balkans digital transformation towards the year 2030.

IMPLEMENTATION DETAILS

Foreseeing the digital transformation's plausible and implausible evolution could be performed using the multiple futures scenarios plausible exploration base *[Minchev, 2015]*. This approach combines expert and crowdsourced user data with additional reference studies support. Successfully joining and fusing these sources is a complex task. Implementing different structures and dynamics with the pool for likely outcomes in the changing context could also vary for the multiple futures, so a family of perspectives and study dimensions has to be used.

A suitable solution in this practical problem-solving exercise could be obtained with morphological (structural) analysis *[Ritchey, 2011]*, providing a comprehensive enough capability for the future socio-technological environment studying and the original establishment of an exploration landscape.

This future transformational landscape main objective is to identify tangible and intangible scenario elements, encompassing data from the "Secure Digital Future 21" expert forum's works *[SDF, 2020]*, adding also some regional feedbacks from the recent 4th eSecurity Conference and 35th International Conference on ICT Systems Security and Privacy Protection – IFIP SEC 2020.

The collection and generalization of input data was organized, accomplishing morphological (structural) analysis performed over a weighted undirected graph model in I-SCIP-MA environment *[Minchev, 2015]*. A resulting cross-consistency scenario matrix of mutually exclusive alternatives is finally generated. The inputs' uncertainties, semi structuring and noisy character are handled with a fuzzy sets extension weighting support to the analytical process of scenarios building.

The scenarios matrix samples are established from the unidirectional graph model, using a single alternative (node) from each dimension (suitably labeled and marked with different colors) in one scenario combination. The common arc weight calculation is performed, implementing a Relative-Common-Weight – RCW fivefold extended assessment *[Minchev, 2015]*.

The scenario building logic and common entropy equilibrium is assumed from both the driving factors and transformation perspectives of a sixfold scenario combination (see e.g. the ones marked Scenario 7 from ***Figure 1***: "Mixed Excesses" -> "Smart Infrastructure" -> "Advanced Interactions" -> "H-M Securing" -> "Security Complexity"-> "H-M Smart Symbiosis").

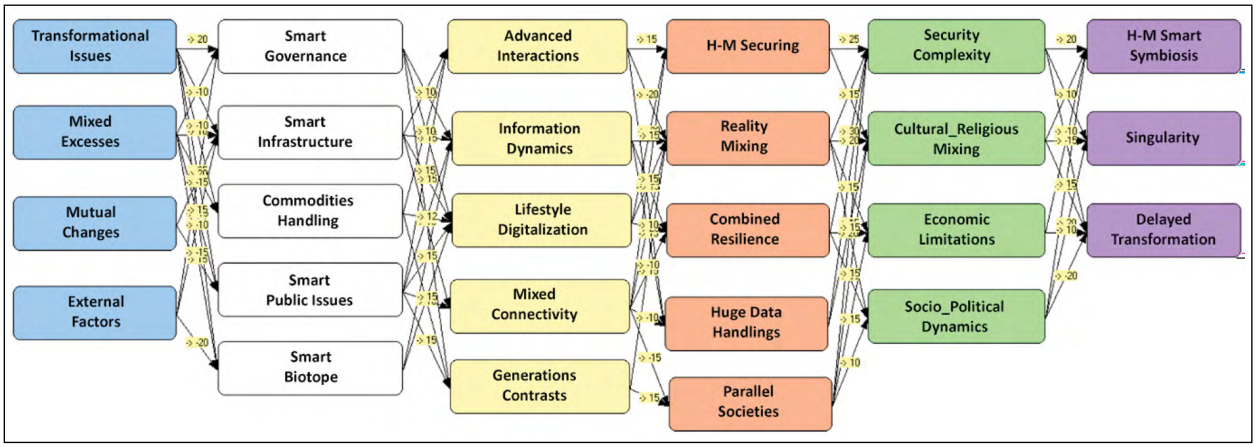

Fig. 1: *Graph-based model representation for digital transformation extended exploration for the Balkans region in I-SCIP-MA environment*

Morphological Analysis

Driving Factors	Digital Services Advances	Socio_Tech Ambiguites	Security Transcendents	Regional Specifics	Tranformation Perspectives
Transformational Issues	Smart Governance	Adnvanced Interactions	H-M Securing	Security Complexity	H-M Smart Symbiosis
Mixed Excesses	Smart Infrastructure	Information Dynamics	Reality Mixing	Cultural_Religious Mixing	Singularity
Mutual Changes	Commodities Handling	Lifestlyle Digitalization	Combined Resilience	Economic Limitations	Delayed Transformation
External Factors	Smart Public Issues	Mixed Connectivity	Huge Data Handlings	Socio_Political Dynamics	
	Smart Biotope	Generations Contrasts	Parallel Societies		

Index	Length	Weight	Name
1	6	55	Scenario1
2	6	85	Scenario2
3	6	40	Scenario3
4	6	100	Scenario4
5	6	45	Scenario5
6	6	25	Scenario6
7	6	60	Scenario7

Active scenarios +

Passive scenarios –

Fig. 2: *The resulting cross-consistency scenario matrix for digital transformation extended exploration for the Balkans region in I-SCIP-MA environment*

Three types of scenario classes in the matrix M have been outlined as a result of the morphological analysis implementation: "tangible" (active), "intangible" (passive) and "neutral" within the six dimensions alternatives ("Driving Factors", "Digital Services Advances", "Socio-Tech Ambiguities", "Security Transcedents", "Regional Specifics", "Transformation Perspectives"), having three to five alternatives each.

The total number of the created scenario combinations is N = 36000, obtained by multiplying the dimensions and number of alternatives, i.e., N' = 6x4x5x5x5x4x3. Using expert & data support as stated above, 11266 scenario combinations have been selected and next studied, following RCW assessment results: positive – 7998 (RCW > 0), negative – 2973 (RCW < 0) and neutral – 295 (RCW = 0).

As the resulting security landscape matrix is underlining some details and normally neglecting or blurring others (relying on expert future beliefs for the Balkans region transformational effects in the year 2030), but in a somewhat aggregated manner (while omitting causality feedbacks in the present graph representation), a more detailed system-of-systems modelling was also further used.

RISKS ANALYTICAL MODELLING

The model provides a possibility for practical formalization of a plausible near future digital transformation's socio-technological effects.

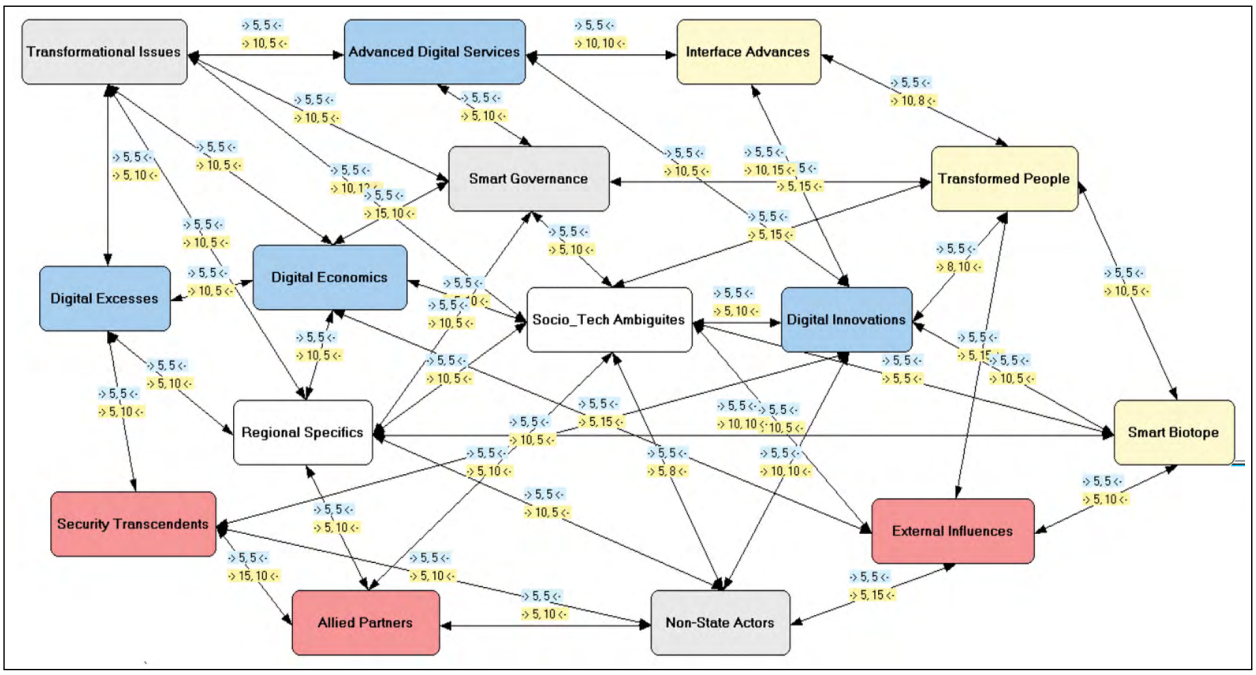

Fig. 3: *System risk model representation for digital transformation extended exploration for the Balkans region in I-SCIP-SA environment*

Selected key assets with neighboring and allied security perspective considerations, region specifics are also incorporated in I-SCIP-SA environment for 15 entities, spread amongst 5 classes for easier handling ("social" – yellow, "technological" – blue, "securing" – red, "transformational" – grey and "featuring" – white). The model entities are interconnected with 42 weighted relations, analyzed with five steps towards ten-years' time horizon, following the ideas from Vester (2007) and Minchev et al. (2019).

The aggregated results for the year 2030 are graphically presented in a three-dimensional cube-based Sensitivity Diagram (***Fig. 4***), providing possibility for model asset sensitivity assessment from a systemic perspective. The results are obtained with respect to feed forward (*Influence*, colored in green) & feed backward (*Dependence*, colored in blue) connections relative weights and have a dual role of active (white) vs passive (grey) in the model.

Finally, the classification is accomplished also regarding four key types of model assets as follows:

• *Active*: "Transformational Issues" (1), "External Influences" (7), "Smart Governance" (8);

• *Passive*: "Digital Economics" (4), "Non-State Actors" (6), "Transformed People" (14);

• *Critical*: "Socio_Tech Ambiguites" (2), "Digital Innovations" (12), "Regional Specifics" (13);

• *Buffering*: "Allied Partners" (3), "Security Transcendents" (9), "Interface Advances" (5), "Digital Excesses" (10), "Advanced Digital Services" (11), "Smart Biotope" (15).

Evidently, in the next ten years, the process of digital transformation for the Balkans is going to be actively related to: the modernization of administration, the development of multiples services of e-governance including e-voting, e-health, together with additional technological innovations in education, trading and entertainment, merging the private sector initiatives with the state efforts fostered by multiple external and internal transformational issues. In this context it is important to note the climate change and COVID-19 pandemic (with other upcoming natural crisis effects expectations *[Waldmann, 2017, Bostrom et al., 2008]*) as highly visible phenomena with negative external effects, as well as the increase in the incidence of social radicalization, the growing mortality for previously improving groups, the rise in unemployment, and the negative global economic growth *[Minchev,*

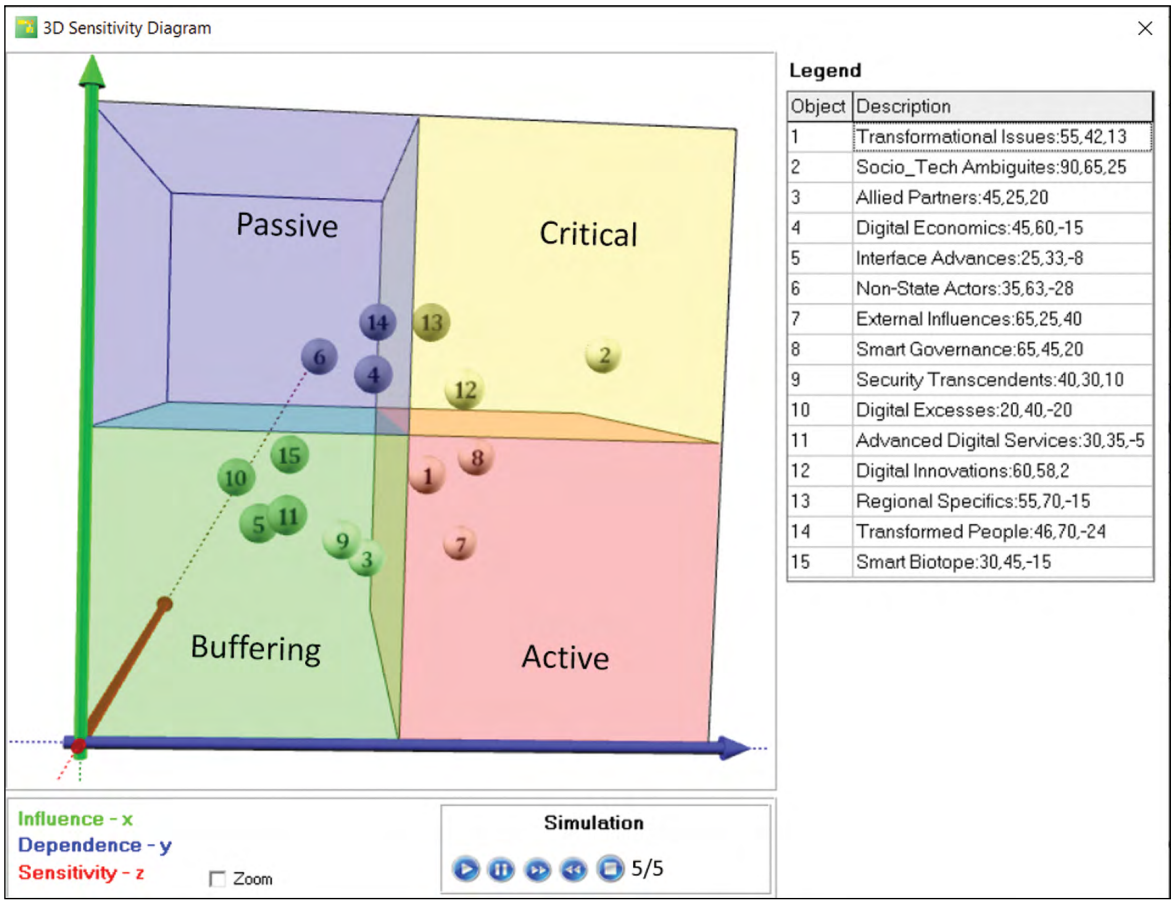

Fig. 4: *The resulting 3D Sensitivity Diagram for digital transformation extended exploration for the Balkans region in I-SCIP-SA environment*

2015, WBG, 2020]. These obviously produce an overall increase in stress that influences the regular lifestyle and are expected to continue to be significant in the future. It is also essential to note the critical importance of the intersection of digital innovation and socio-technological ambiguities, together with the Balkans regional specificities, which lead to efforts towards maintaining good neighborly relations and the possible developments, taking into account the global players and the transformational perspectives of allies.

Aside from this, a more passive but still important presence is expected to come from the assimilation of new digital skills which people need in order to become proficient with new technological solutions and services, encompassing more intelligent, fast, mobile and ultraconnected devices in the new transformed reality. As the economy needs also to handle the new disruptive challenging digital and social transformations, together with numerous external and internal effects, more innovative digital gadgets, solutions, services and financial instruments will naturally be involved. Finally, the allies, partners and security transcedents (adversaries, opportunities, challenges, divides & gaps) are also going to have an active and important role for the digital transformation, accentuating technological innovations and socio-technological ambiguities. What also needs to be marked here are the digital excesses (addressing total substitution of humans by machines due to automation in most of the future jobs and roles for the not so far future of the next 20 years *[Borders, 2018]*, and the significant influences on the human affected biotope, incorporating, for instance, more intelligent and numerous sensors. This will hopefully support the diminution of the socio-technological ambiguities, creating a

suitable base for further achieving a new digitally integrated development pattern robust enough to handle future transformations.

MIXED RESULTS ASSESSMENT

The results assessment was further organized using a mixed human-machine approach, combining expert future beliefs (gathered during the high-level experts' discussions from NATO CA2X2 online Forum and 25th International Military Exhibition "Defence, Antiterrorism & Security" HEMUS 2020 with high performance machine probabilistic simulation). A dynamic exploration on selected entities of interest has been studied, trying to understand the potentially cyclical (periodic or pseudo-periodic) nature of the system model in a selected scenario context. In order to achieve successful implementation of this approach, a somewhat distributed model breaking was performed, on a causality stochastic base representation, similar to Minchev, et al., 2019. This approach gives a possibility to successfully cope with fractal nature dynamics and non-stationarity *[Panchev, 2001]*. Keeping the ratio of accuracy and speed in this context, a sub model cyclical (pseudo-periodic) hypothesis for social evolution towards the year 2030 automatically assumes the presence of certain limitations *[Meadows, 2004]*. Practical probabilistic assumption of Kondratiev's fourfold cycling evolutionary socio-technological progress (covering: prosperity, recession, depression and improvement, after Barnett, 1998) was used (an advancement from Forrester's transitions growth and behavior – being positive, negative or aiming towards equilibrium). Also used is an outlook to multiple degrees of freedom for system risk – R_s assessment (R_s (R_f, R_b) = P (R_i | S_k), where: P (...) is the Beyesian probability, R_i – system risk, $i = \{f, b\}$, S_k – selected k^{-th} scenario from the scenario matrix M (***Figure 1***), using probabilistic piecewise *S*-curve approximation (adopting Beta distribution trends for both a priori and a posteriori assessment) with cyclical machine simulations of the model entities' evolutionary epochs (creating a simulated approximation to the real-life dynamics).

Through the foresight process, some conditions for: Δ – time delay bounding (for a certain arc weight value) and λ – state switching (for branching in the above Kondratiev-Forrester joint assumption *[Minchev et al., 2019]* have to be empirically identified, using both expert and machine experimenting. Having a heuristic character however and being an experimental objective, these two parameters' values could be easily adjusted with the accuracy of a cubic polynomial, using non-linear forecasting techniques, following Minchev (2017). Apart from this, λ in itself is a rather complex parameter, so supplementary system model could be added between the phases transition for a better understanding of the process. While accomplishing this task, different evolution scenarios could be explored *[Frank et al., 2018]*, (assuming risk as a dual stochastic variable involving the vulnerability/impact ratio), following a supportive fundamental probabilistic synchronization overall trend, based on the ideas of Lindberg (2012) and Smolenov (2016).

An example, concerning the digital plausible dynamic system-of-systems model of the socio-technological Balkans transformation (***Figure 3***) for "Smart Governance" R_s evolution (***Figure 5 a,b***) is given below.

It is also important to note the resulting approximation intervals (M1-M3, MM1-MM3) that actually determine the cyclical dynamic phases (prosperity, recession, depression, improvement, marked with numbers and different colours, following ***Figure 5***) probabilistic order for the different plausible scenarios from M (see ***Figure 1*** and ***Figure 2***). What however stays uncertain is the non-uniform periodicity of the studied relations' natural dynamics and machine overlaps that have to be assumed as general methodological imperfections. The last could be somewhat handled by mixed-reality simulation experimental assessments (see e.g. Minchev, 2015, and Minchev, 2020) and expert discussions marked hereafter.

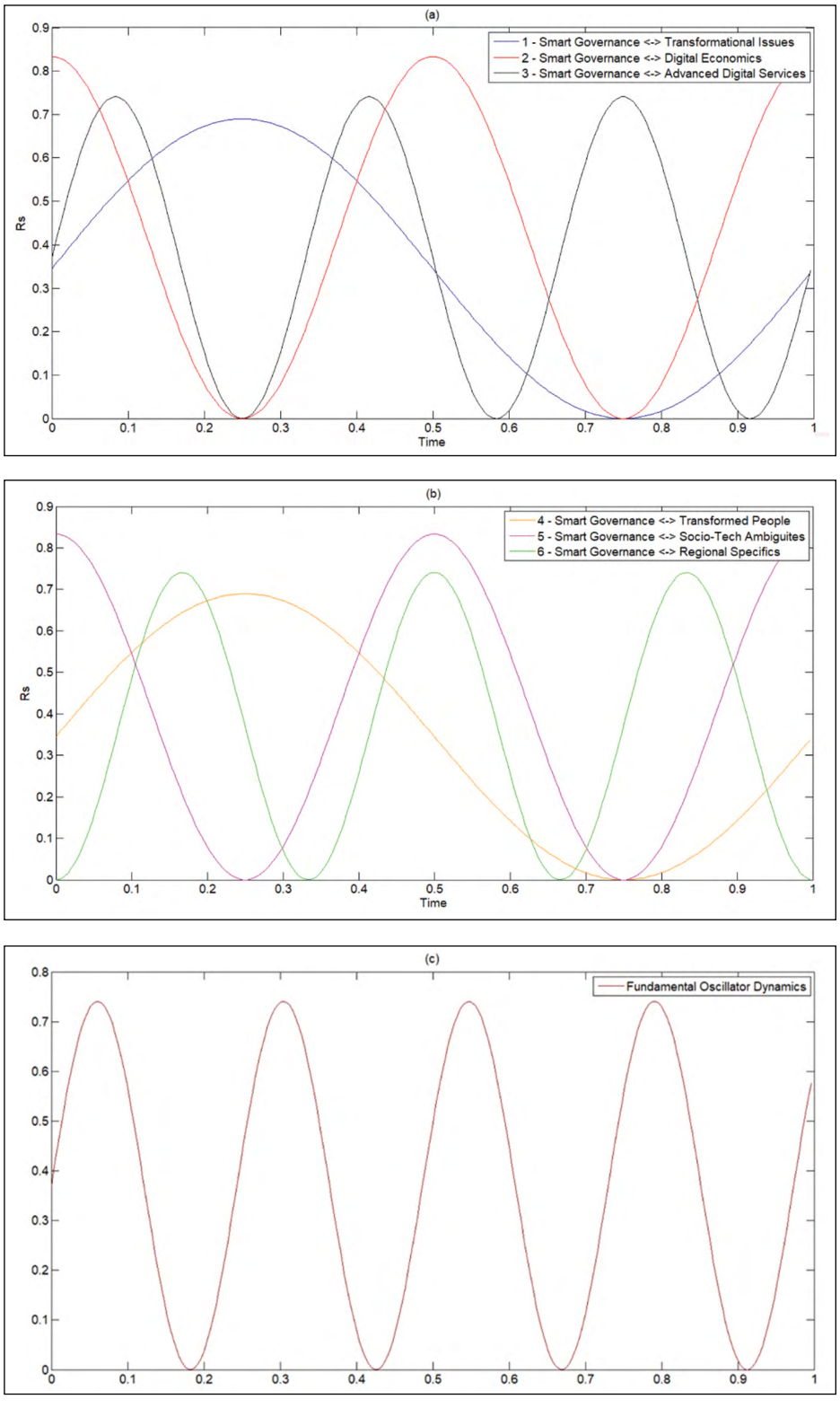

Fig. 5: *A probabilistic trends exploration example for "Smart Governance" a priori R_s values (a) & (b) synchronized with the concept for a fundamental oscillator dynamic probabilistic trend (c), concerning the socio-technological evolution up to year 2030, following the system model from Figure 3*

Being certainly quite vague, the presented human-machine assessments have been also empirically verified with several suitable expert discussions, all marked in the framework of Secure Digital Future 21 Expert Forum: Round Table on CIO during DIGILIENCE 2020, IICT Future Threats & Military Advances Expert Seminar within 25th International Military Exhibition "Defence, Antiterrorism & Security" HEMUS 2020, 4th eSecurity Conference Panel Discussions.

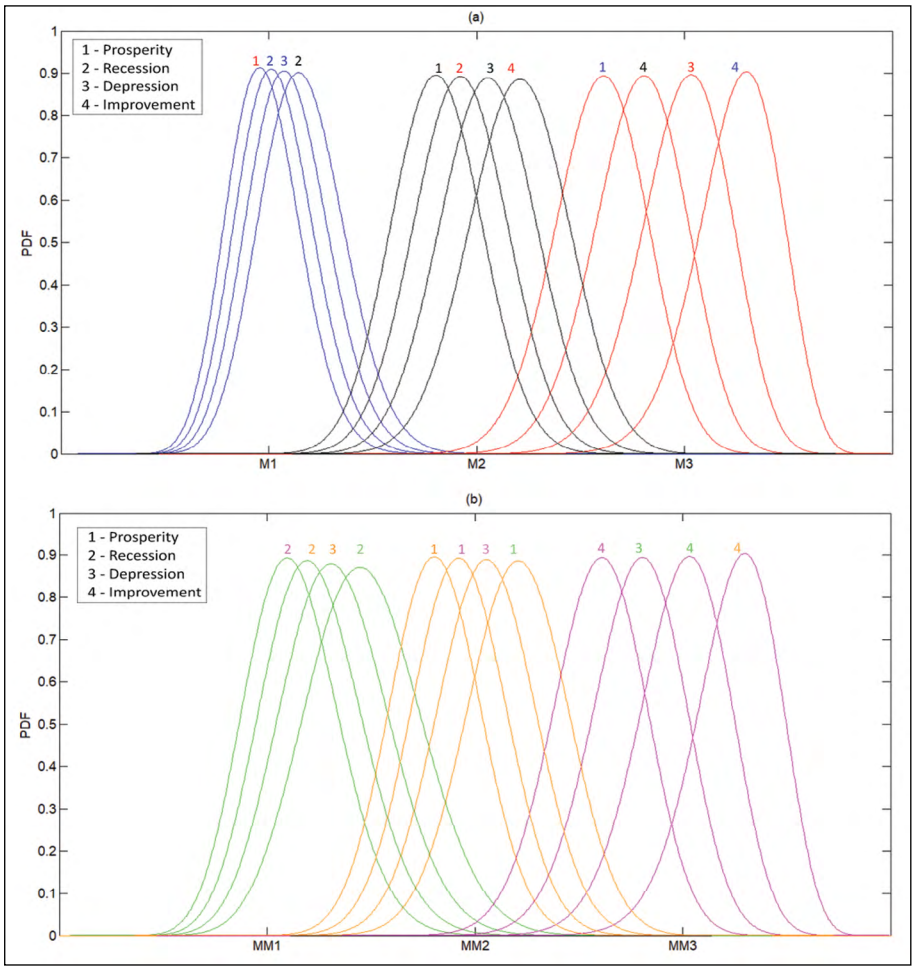

Fig. 6: *Resulting probabilistic trends exploration example for "Smart Governance" (following Figure 5 a,b) a posteriori PDFs, aggregated around three interval nodes each, towards the year 2030*

a)

b)

c)

Fig. 7: *Selected moments from: IICT Future Threats & Military Advances Expert Seminar within HEMUS 2020 (a), Round Table on CIO during DIGILIENCE 2020 (b) & 4th eSecurity Conference Panel Discussions (c)*

DISCUSSION

The digital transformation in the Balkans region for the next ten years will definitely encompass a wider shift, given also the competition between human and machine intellect with the changing ecosystem due to natural, manmade and joint human-machine advanced driving factors. Thus, a comprehensive understanding of the newly established transformation landscape will definitely require more investment in human capital and technological resources. Further, several strategic objectives could be stated in the context of summarizing the paper's analytical findings:

- Innovation is vital for the younger generation's perspectives and it imparts a disruptive character to the future transformation;
- Neighborly cooperation and contradictions are possible drivers to both dystopian and utopian futures and it is up to people to decide how they want to live in the Balkans, keeping the symbiosis with the big powers and economy/military unions;
- Increasing the digitalization level of the administration, of elections and of general governance will inevitably foster a new level of civil control, giving more trust from the people to the politicians;
- Adding lifestyle technological advances and services will transform socio-technological ambiguities that have to be handled in a fast and dynamic environment;
- The future jobs and the wider economy are definitely going to be strongly influenced by the digitalization as it creates possibilities and helps to overcome the difficulties related to external pandemic and climate negative changes drivers;
- The establishment of the comprehensive and resilient future socio-technological landscape requires a multilevel and multirole symbiotic human-machine effort that will open a new security transcendent, specific to the Balkans region.

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