Center for Energy and Value Issues
CEVI

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- **From the editor: introducing this EVL issue**
- **Call for Papers 8th CEVI Conference, UCL Belgium *(online)***
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- **Call for Papers: Economics and management beyond rational decision making (Special Issue of CEREM)**

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Editorial Policy

The Energy and Value Letter brings together academics and practitioners worldwide to discuss timely valuation issues in the energy sector. It publishes news from the Centre for Energy and Value Issues (CEVI), its linked organizations and others (including calls for papers), columns on topical issues, practitioners' papers: short articles from institutions, firms, consultants, etcetera, as well as peer-reviewed academic papers: short articles on theoretical, qualitative or modeling issues, empirical results and the like. Specific topics will refer to energy economics and finance in a broad sense. The journal welcomes unsolicited contributions. Please e-mail to **w.westerman@rug.nl** (Wim Westerman), a copy of a news item, column or a completed paper. Include the affiliation, address, phone, and e-mail of each author with your contribution. A column or news item should not have more than 600 words and a paper should not exceed 5,000 words, albeit that occasionally larger pieces can be accepted.

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About this issue

Wim Westerman
Editor Energy and Value Letter

University of Groningen, The Netherlands
e-mail: w.westerman@rug.nl

Have a Happy 2021! While using likewise words last year, one could not imagine how things would evolve later on. I referred to activities such as a meeting of the Central Asian Productivity Research Center in Chicago in January (already before "Corona"), a CEVI workshop at the 14th ISINI conference in Wroclaw, Poland, in August (postponed to September and held virtually), the publication of the 7th CEVI book at Springer (early 2020) and the start of the preparations for the 8th CEVI volume, edited by André Dorsman, Mehmet Baha Karan, Kazim Atici and Aydin Ulucan (which is well underway now).

While all of these events did take place and were great successes, we have to admit that "Corona" has been hindering us severely lately. One way or the other, a virtual conference is nice and has the advantage of people being around who could not have made it else and keeping contacts alive, but it is not "the real thing". Recently, the The CAPRC Annual Central Asian Energy Seminar, originally scheduled at the conference center of the Turkish Consulate in Chicago, has been postponed. Seminar chairman Ozgur Arslan Ayadin says: "we need to evaluate the situation after the pandemic diminishes". At the same time, she is excited on the news about the progress of the energy industry in Central Asia.

Also, the CEVI board regrets to tell that the upcoming conference will be held online only. Conference organizer James Thewissen of UCLouvain in Belgium notes: "if people from outside Belgium and The Netherlands cannot travel, it is not wise to conduct the conference physically in 2021. People need to book their flights in advance to have a good rate and make sure they get their permission to travel without quarantaine." The good news is that the conference will be held, albeit in a slightly different format then normally. We are also happy to announce that UCLouvain will host the CEVI conference in 2023. At the moment, we are not sure yet how the ISINI participation will look like. For more information, please refer to the adapted Call for Papers, with an extended deadline for sending in papers.

Via ISINI chairman and Editor-in-Chief of the Central European Review of Economics and Management Joost Platje (johannes.platje@wsb.wroclaw.pl) we received a Call for Papers on "Economics and management beyond rational decision making". One would easily be able to relate this to the current COVID-19 crisis, but the scope of the special issue of CEREM is however broader. CEVI members are cordially invited to contribute. Be sure to send in your abstract by February 15th though. For more information see the Call for Papers, which is included at the end of this issue of the EVL.

The EVL is not just a newsletter, but also acts as a journal where practitioners and academics share experiences via columns, short articles and occasionally larger papers. I am therefore happy to introduce paper related to the one by Erik van Leeuwen in the former issue. This one is by Wietze Lise in cooperation with colleagues from Switzerland and Iceland. The Pan-European team of authors shows that there is, under reasonable but sophistically to be handled circumstances and with the current governmental risk sharing scheme, ample room for geothermal power generation in Turkey. With this good news, the first issue of the 13th volume has a happy end!

The 8th MULTINATIONAL ENERGY AND VALUE CONFERENCE (online)

You are cordially invited to submit your research papers for presentation consideration at the CEVI conference that will take place on **May 6th - 7th, 2021.** This conference, hosted by the LIDAM group of the Université catholique de Louvain (UCL), will be *exceptionally organized online* and aims at bringing together academics and practitioners from all over the world to focus on timely energy finance and investments, financial performance, energy markets and valuation issues in the energy sector. Papers dealing with developed as well as developing countries are welcome. Specific topics refer to energy issues and include, but are not limited to:

Financial Regulation; Financial Markets; Financial Risks; Asset Pricing; Value at Risk; Capital Structure; Sourcing Capital; Corporate (Re-) Structuring; Corporate Governance; Behavioral Finance; Financial Performance; Cost Control; Financial Accounting; Fiscal and Legal Issues.

This conference is organized in collaboration with the Center for Energy and Value Issues (Amsterdam, Netherlands) and the Energy Markets Research and Application Center of Hacettepe University (Ankara, Turkey).

Keynote speaker

Mr. Philippe Henry Vice-President of the Walloon Government and Walloon Minister of Climate, Infrastructure, Energy and Mobility.

Submission

Please submit your papers (completed or nearly completed) or participation interest via e-mail to: James Thewissen (ceviconference@gmail.com), by January 25th, 2021. Authors will be notified regarding the acceptance of their papers after reviewing. Final acceptance of full papers will be notified by January 30th, 2021.

Conference Fee

No conference fee.

CEVI Book

Papers selected for this conference may be submitted for possible publication in a CEVI book, dedicated to this conference by Springer Verlag, or inclusion in CEVI's Energy and Value Letter (EVL). All submitted papers will be subject to a blind peer review process. Further information regarding conference organization and accommodation, travel arrangements, fees and activities will be published on the conference website in due course. For any inquiry regarding the submission process and registration at the conference please contact Prof.dr. James Thewissen (UCL) by e-mail at: ceviconference@gmail.com

2023 CEVI conference

Due to the sanitary conditions, we had to adapt the conference format and decided to exceptionally organize the meeting online. However, the good news is that we have already planned the 2023 conference at the Université catholique de Louvain. We will keep you updated.

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Towards more geothermal power in Turkey

Wietze Lise
Energy Market unit, MRC Turkey, Ankara, Turkey

e-mail: *wietze.lise@mrc-tr.com*

Ralf Brauchler
AFRY Swiss, Baden, Switzerland

Bjarni Richter
ÍSOR, Iceland Geosurvey, Reykjavík, Iceland

Dadi Thorbjörnsson
ÍSOR, Iceland Geosurvey, Reykjavík, Iceland

Helga Tulinius
ÍSOR, Iceland Geosurvey, Reykjavík, Iceland

Gudni Axelsson
ÍSOR, Iceland Geosurvey, Reykjavík, Iceland

Abstract
The energy policy of the Turkish government has two main priorities, namely (a) maximizing exploitation of domestic primary energy resources and (b) securing sufficient, reliable, and affordable energy to a growing economy in an environmentally sustainable manner.
There is a supportive legal framework to facilitate geothermal development, with a feed-in tariff of 105 USD/MWh for geothermal power, for a 10-year period from the commissioning date, with an addition of up to 27 USD/MWh, for a 5-year period from the commissioning date, to reward the use of locally produced equipment. This is valid for geothermal power plants being commissioned until June 2021.
Geothermal resources in Turkey are used for power production, as well as for space heating and tourism related applications. The installed capacity of geothermal power plants in Turkey has grown from 15 MWe in 2006 to 1,515 MWe in 2020. However, capacity development has mainly taken place in the Aegean region, namely the Menderes and Gediz Grabens. The target is to reach 2,000 MWe geothermal power capacity by 2023.
The key research question of this paper is: how can Turkey attract new investments and further increase the installed capacity in geothermal for power generation? Thereupon, this paper will assess the current situation of geothermal in Turkey and point out the potential and the geographical hotspots, which should be focused on to further develop geothermal power. The literature on investments in geothermal power will be assessed, leading to an estimate of the reasonable installed capacity per drilled production well. A simple business model needed for profitable investments will be discussed. Financial support in the form of a risk-sharing mechanism (RSM), which has recently been launched in Turkey will be crucially important.

1. Introduction

The energy policy of the Turkish government has two main priorities, namely (a) maximizing exploitation of domestic primary energy resources, and (b) securing sufficient, reliable, and affordable energy to a growing economy in an environmentally sustainable manner.
In this context, the government of Turkey has put in place a supportive legal framework to facilitate geothermal development. A critical milestone was the Geothermal Law of 2007. This set out the rules and principles for effective exploration, development, production, and protection of geothermal and natural mineral water resources. In 2010 an amendment to the Renewable Energy Law established a feed-in tariff of 105 USD/MWh for geothermal power, for a 10-year period from the commissioning date, with an addition of up to 27 USD/MWh, for a 5-year period from the commissioning date, to reward the use of locally produced equipment. This is guaranteed for geothermal power plants being commissioned until 30/06/2021 (extended with six months in September 2020).
Geothermal resources in Turkey are used for power production, as well as for space heating and tourism-related applications. The installed capacity of geothermal power plants in Turkey has grown rapidly in recent years, from some 15 MWe in 2006 to 1,515 MWe produced by 54 power plants in August 2020. Moreover, power plants with a total installed capacity of 167 MWe are under construction and another 477 MWe has obtained a pre-license, as of SEP 2020. This rapid growth has led the government to increase the target of developing 1,000 MWe geothermal electric generation capacity by 2023 to a target of 2,000 MWe (JD, 2019). However, this growth has been restricted to Western Turkey; most of the capacity development has taken place in the Menderes and Gediz Grabens.
The key research question of this paper is: how can Turkey attract new investments and further accelerate the installed capacity in geothermal for power generation?
The outline of the paper is as follows. Section 2 will assess the current situation of geothermal power gneration in Turkey and point out the potential and the geographical hotspots, which should be focused upon to further develop geothermal power. The literature on investments in geothermal power will be assessed in Section 3, leading to an estimate of the reasonable installed capacity per drilled production well. A simple business model needed for profitable investments will be discussed in Section 4. Financial support in the form of a risk-sharing mechanism (RSM),[1] which has recently been launched in Turkey will be crucially important. Section 5 draws the main conclusions.

2. Assessment current situation of geothermal power generation in Turkey

As of the end of August 2020, there is about 1,515 MWe of installed capacity in geothermal power in Turkey (TEIAS, 2020). Table 1 shows the breakdown of the installed capacity of geothermal by province. We can see from Table 1 that the highest installed capacity is in Aydın followed by Denizli and Manisa. These provinces are the hot spots for geothermal development in Turkey. In addition, some geothermal power plants are also found in Çanakkale and Afyonkarahisar.

[1] More information about the RSM and the application procedure is available via http://rsmgeoturkey.com

Table 1 – Distribution of installed capacity of geothermal power in Turkey as of August 2020

PROVINCE	NUMBER OF POWER PLANTS	TOTAL INSTALLED CAPACITY IN MWE
Aydın	28	770
Manisa	15	380
Denizli	8	347
Çanakkale	2	15
Afyonkarahisar	1	3
TOTAL	**54**	**1,515**

Source: EA (2020)

Figure 1 shows a map with key geothermal locations. Hence, the hotspots for geothermal can be found in the Menderes and Gediz grabens in the provinces of Aydın, Denizli and Manisa.

Figure 1 – Distribution of locations with geothermal resources suitable for electricity generation and power plants in Turkey

Sources: Aksoy (2014), Kilic (2016).

Karamanderesi (2013) presents the key geographical characteristics of geothermal reservoirs in Turkey. Well-known geothermal fields are Kızıldere, Germencik, Salavatlı, Alaşehir-Alkan, Salihli-Caferbeyli, MDO-1 well, Sandıklı AFS wells, Afyonkarahisar geothermal area, and Çanakkale Tuzla. Geothermal resources can also be found in central and eastern Anatolia.

Mertoglu, Simsek and Basarir (2015) report on the geothermal potential in Turkey. These are reported as 4,500 MWe for power generation[2] with well depths up to 3 km, whereas the potential of direct use has been increased from 31,500 to 60,000 MWth (JD, 2020). An important step for accelerating geothermal development has been the geothermal law No 5686 of 2007. Together with the FIT for geothermal power production, the installed capacity has increased substantially. The geothermal potential in Turkey is also studied in detail by Korkmaz, Serpen and Satman (2014). They arrived at a lower estimate for geothermal power potential, namely 2,263 MWe. In 2017, Turkey entered the so-called 1 GWe country club with respect to geothermal power installed capacity, where Turkey is ranked fourth in the world after the USA (3,591 MWe), Philippines (1,868 MWe) and Indonesia (1,809 MWe) (TGE, 2019).
Ates and Serpen (2016) focus on which technology to choose to optimally fit the characteristics of the geothermal reservoirs. Based on a model simulation analysis the authors conclude that a model using a single flash and binary cycle processes together to be an optimal choice for many reservoirs in Turkey.

3. Literature on investments in geothermal power

ESMAP (2012) provides a handbook on the planning process and financing geothermal power projects. Figure 2 shows how risks develop over time in the project cycle, where the need for financial support, such as RSM is particularly important during the exploration phase. The risk to the investor is typically the highest during the exploration phase until test results have been obtained. After establishing the presence of a geothermal resource, the risk lowers considerably, and it should be relatively easy for the investor to secure finance for the next steps.

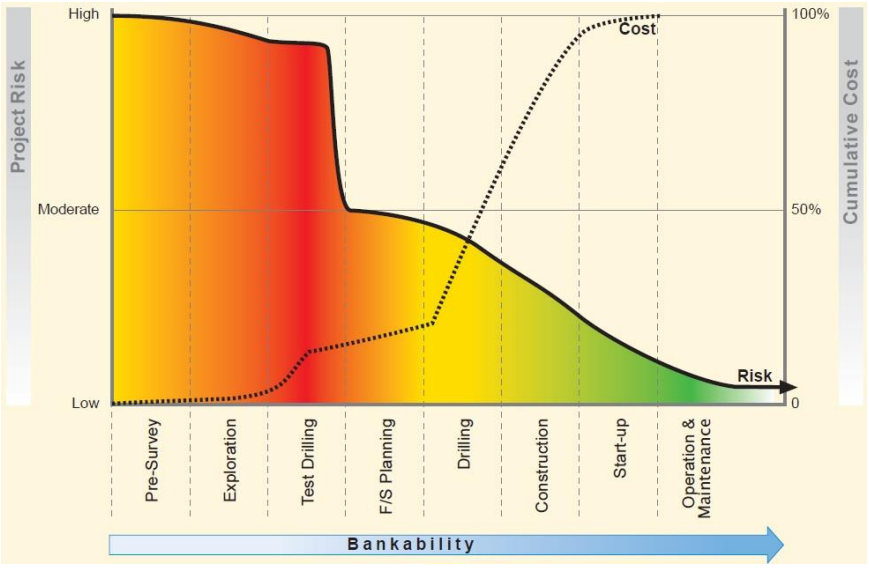

Figure 2 – Project Cost and Risk Profile at Various Stages of Development
Source: ESMAP (2012).

[2] Melikoglu (2017) also uses the number of 4,500 MWe of geothermal power potential in Turkey.

Pater Salmon *et al.* (2011) provide a guidebook into recent trends in geothermal power finance, which is based on experiences in the USA. Figure 3 summarizes the main results. Figure 3 shows a similar pattern as in Figure 2, namely that the risk level drops after identifying a geothermal resource. The reduction in risk is expressed in easier financing terms as the geothermal power plant comes closer to operation.

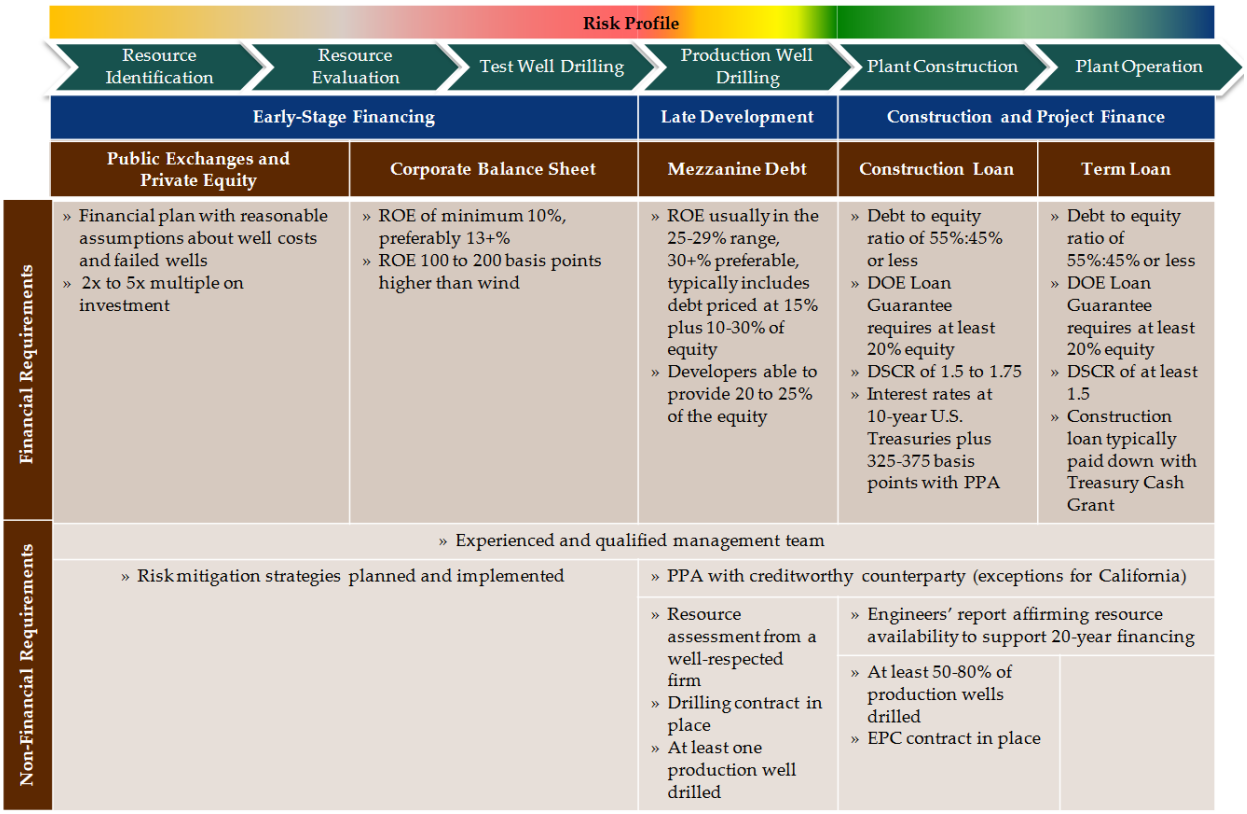

Figure 3 – Key information for financing the development of geothermal power plants
Source: Pater Salmon *et al.* (2011).

IFC (2013) focuses on success criteria for geothermal wells, developing a database of wells from all around the world, covering 2,613 wells. The main conclusion is that 78 percent of the drilled wells were considered successful. However, the success for the first well is determined at only 50%, whereas the success rate for consecutive wells after one successful well is going up quickly. The average capacity per well is 7.3 MWe in that study, but averages vary significantly between different geothermal areas and resource types. The total dataset is skewed with a few very large wells. It is better to consider the modal average capacity, which is 3 MWe. That geothermal fields are generally small is also confirmed by WEC (2016).
Olivier and Stadelmann (2015) present a very detailed case study of one power plant in Turkey: Gumuskoy, which is the first geothermal power plant where the exploration costs and risks has been borne by the investor. In the end, the risk-taking appetite of the investor paid off and this project led to a profitable enterprise.

4. A simple business model for profitable investments

Financial modeling of geothermal power plants has been undertaken by various authors. Gunnlaugsson (2012) presents the financial detail of a large geothermal power plant in Iceland. Ngugi (2014) has built a financial model for geothermal power projects in Kenia. Chatenay and Johannesson (2014) compare the economics of geothermal power plants to other power generation technologies.

In order to build a simple financial model relevant to Turkey, the following bullet summarize the key assumptions:

- Key drivers of profitability are the CAPEX and OPEX. These are taken as 4000 USD/kWe net installed capacity for CAPEX and 100,000 USD/MWe net installed capacity for OPEX.
- The net installed capacity is taken as 5 MWe.
- From year 7 onwards, a new well will have to be added every five years to maintain the flow to the power plant, where the well cost is assumed as 2 million USD.
- A flat 80% availability is assumed, which is equal to 7008 running hours.
- Prices are 115 $/MWh for the first ten years and 75 $/MWh for the next 15 years, all assumed to be in nominal USD.
- Depreciation and amortization are assumed to be 10%.
- The loan is dispatched in 2 years and paid back in 11 years in equal instalments.
- Interest payments for the first two years are added to the CAPEX as financing costs.
- The projections are made in nominal USD.

The result of the financial model with these assumptions is as follows: the profitability in terms of project internal rate of return or project IRR is 11.1%. This is a sufficiently high rate of return. However, the key driver of this result is the ability to benefit from the going FIT, which means that the project needs to be commissioned until June 2021. Also, if some of the drilled wells are not successful, this may add to the cost of the investment and lower the overall profitability considerably. To have insurance against this risk, there is a need for a RSM, which is currently available in Turkey.

5. CONCLUSIONS

Turkey has entered the so-called 1 GW country club with respect to geothermal power installed capacity. Moreover, Turkey is ranked fourth in the world after the USA (3,591 MWe), the Philippines (1,868 MWe) and Indonesia (1,809 MWe) (TGE, 2019). The development of geothermal installed power capacity in Turkey, has gone quicker than expected, driven by a favorable regime with feed-in tariffs (FIT), namely 105 $/MWh for ten years, which may be increased with another 27 $/MWh for five years for including local equipment in the investment. However, these projects need to be completed by the end of June 2021. Initially the official target was to reach 1 GW until 2023; this has been revised to 2 GW until 2023, in line with recent developments. Turkey has an extensive potential for geothermal power, estimated to around 4.5 GW. To reach this potential, the current FIT regime will need to be extended to projects that will be commissioned from 2021 onwards.

Also new areas need exploration, which may be suitable for geothermal power development. Here the literature shows that the largest risk of the investor is during exploration. Moreover, the likelihood of drilling a successful well increases as more wells are drilled in the same location. Also, according to IFC (2013), across all resource types, the average size of a successful production well has been estimated to be around 3 MWe globally and Turkey is no exception to this. Here, to facilitate exploration drilling in new areas, there is a need for a Risk Sharing Mechanism (RSM), which is currently an ongoing project in Turkey funded by the Clean Technology Fund through the World Bank.

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Call for Papers: Economics and management beyond rational decision making

The COVID-19 pandemic might be incorrectly framed as a classic example of a Black Swan that for many players in society came as a complete surprise (Platje, Harvey, Rayman-Bacchus 2020). Incorrectly, because a pandemic of this magnitude, though not COVID-19 specifically, was predicted as being waiting to happen (Taleb 2007). The apparent surprise reveals that available information on disasters-to-be is systematically ignored (Van Dam, Webbink 2020). The Black Swan of COVID-19 turned out to be the black elephant in the socio-economic room: impossible to miss, but everybody pretends it is not there (Will 2020).

One may or may not wonder whether this ability to ignore inconvenient information is a human deficit or a global socio-economic systematic deficit. One cannot deny that this tendency to ignore threatening information has repercussions for theory construction in economy and management. Classical and neoclassical economy are based on fully informed rational decision making. Behavioural economics has relaxed this assumption and is based on bounded rationality and incomplete information. Strategic management, as well as risk and business continuity management has rational decision making as its foundation. Neither economics nor management is prepared to handle intentional denial of information and nonrational decision making in its theories and models. This in itself may be a plausible explanation of why economics and management fail to get a grip on sustainable economic development.

Merely redefining ‘information’ as ‘external input that results in behavioural change’ reduces the issue to a meaningless tautology. Conversely discarding cognitive processes like needs and motives (Van Dam 1997) as explanation of economic behaviour implies that *“human behaviour is less complex than most psychologists had hoped for*” (Nuttin 1975: 216). Examples of non-rational and non-cognitive models are, e.g., behaviourism in psychology or cybernetics in management. Radical behaviourism has long rejected unobservable mental phenomena as explanans of behaviour (Skinner 1974) and cybernetics has offered managerial models that are based on observable behaviour only (Beer 2002). The application and acceptance of these models in economics (Lea 1978, 1981), marketing (Foxall 1986, 2001), and management (Cammaert 1984; Espinosa Porter 2011) has been limited.

We invite any kind of original contribution and/or reflection to the topic of non-rational and non-cognitive theory in economics and management, related to sustainable development, COVID-19 or human stupidity. Proposals for issues and topics with regard to ignorance and decision making in pandemics are welcome. Possible topics are, but not limited, related to the following questions:

- If the “purpose of a system is what it does” (Beer 2002), then what is the purpose of the incumbent economic systems?
- Whether a more sustainable society requires a change of purpose or a change of system?
- What is the economic rationality of misinformation and ‘denial of inconvenient truths’? Determinants of ignorance of warning signals of high-impact threats.
- Non-cognitive models and voluntary or deterministic behaviour?

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Markus Will, University of Applied Sciences Zittau/Görlitz. Germany
Joost Platje, WSB University in Wrocław, Poland
Please send the abstracts to: Joost Platje, E-mail: johannes.platje@wsb.wroclaw.pl

15 Februari 2021	–	Submission of Abstract
28 Februari 2021	–	Notification of status invitation to submit full paper
30 April 2021	–	Deadline for submission of full paper
June 2021	–	Publication

The abstracts should have the following structure:

Aim: The author(s) should shortly explain the reason or motivation for taking up the research problem (why is the topic important?), and what is the objective or aim of the research. The aim should be clearly formulated, and be specific enough to be achieved within the range of the paper.

Design / Research methods: The authors should clearly explain the way in which the aim or objective is achieved. The main research methods as well as the approach to the research should be provided that enable effective dealing with the paper's aim.

Conclusions / findings: What are the main results of the research? The authors should refer to the analysis, discussion or results of the paper in order to show the main findings.

Originality / value of the article: Within the context of the current state of the art in science, what is new or what is the scientific value added of the paper? For whom would the paper be of interest?

Implications of the research (if applicable): How and to what extent can the results of the research be applied to practice? What are the consequences of application of the research findings to practice?

Limitations of the research (if applicable): Does the research imply directions or suggestions for future research? What are the limitations of the research methods used? What are the limitations of the implications of the research findings?

Keywords:

JEL codes:

Please refer to the Journal information for author guidelines:
https://www.cerem-review.eu/publish-in-cerem/
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About CEREM

The Central European Review of Economics and Management (CEREM) is an open-access scientific journal, focusing on state-of-the-art theoretical as well as empirical studies in the field of economics and management. It aims to create a platform for exchange of knowledge and ideas between research, business, governmental and other actors. Besides more traditional scientific papers, the journal welcomes conceptual papers, opinion papers and policy discussions from academic, corporate, governmental and civil society representatives.

An important aim of CEREM is to stimulate open-minded discussion of new ideas, new applications of old ideas as well as development of interdisciplinary approaches to current challenges in economics and management. This is of particular importance in the substantial changes that have taken place and are expected to take place in the world.

The principle of double-blind peer review applies. Contributions should be original and previously unpublished. Articles submitted to the Central European Review of Economics and Management should not be under consideration for publication elsewhere.

Literature

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