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UNDERSTANDING THE PROFITABILITY OF THE ENERGY (EFFICIENCY) INVESTMENTS – THINGS TO CONSIDER BEFORE PUTTING BILLIONS INTO GAME

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Background (abstract)

- Investment analysis is never an easy task. Not even in those situations where the calculations as such may be somewhat straightforward. The profitability of the investment ultimately depends on the events and coincidences of the future and cannot be known for sure beforehand. Nevertheless, a sophisticated investment analysis should recognize and describe different futures and be able to quantify them for calculation purposes.
- Many experiences and observations suggest that investment analysis tends to be simplistic and may focus only on single figures. For example, experience from the Finnish energy investment landscape shows that even relatively large investments could be considered based on payback time calculation alone. It is unclear why the approaches and procedures seem to be so simple.
- The ongoing energy transition suggests that the existing investment landscape is very complicated and more thorough analyses would be useful rational. A deep exploitation of both quantitative and qualitative approaches is supposed to be useful when considering hundreds of billions of energy-related investments in the Europe alone in the coming years.
- A possible enhancement for investment analysis is applying methods from the field of real estate valuation. Standardized valuation methods have been in use there for decades. Quantitative conclusions are based on deep qualitative considerations and highly developed procedures could have great relevancy in the energy sector as well.

About the authors

- Ari Laitala M.Sc. (Tech.) works as a project manager in Sykli Environmental School of Finland and leads research related projects in the field of real estate and energy efficiency.
- Ari has been specialized in quantitative methods in his work and publishes actively in the professional press

- Saija Toivonen D.Sc. (Tech.) works as an assistant professor in Real Estate Economics at Aalto University with a wide range of topics concerning the real estate market. Her special interest is applying futures research methods into real estate market research.
- Her research scope includes themes such as understanding the future development of real estate supply and demand, foreseeing the future impacts of different drivers as well as developing strategies and services aiming for a more sustainable real estate sector.

RQ: What is the true nature of the profitability/value of the investment?

- We will apply some approaches/methods used in real estate valuation
  - Concepts, terminology
  - Following especially International Valuation standards (IVS)

- So, we focus on
  - Income approach (≈> Net present value)
  - To be more exact: 60. IVS-Defined Basis of Value – Investment Value/Worth
  - "Investment Value is the value of an asset to a particular owner or prospective owner for individual investment or operational objectives."

- Not Payback time
- Not Internal Rate of Return

We apply some real life numbers in our case study

https://www.helen.fi/aurinkopaneelit/aurinkopaneelipaketit/aurinkolaskuri

We´ll calculate the profitability of the solar panel investment

- We will focus on to determine incomes of the investment!
- Investment cost can be found somewhat easily!
- Our case study: housing company of three separate block of flats
  - We expect (on yearly average)
  - 53048 kWh + 55749 kWh + 82424 kWh = 191221 kWh

We use direct capitalization

- After studying (2020) the distribution profile of the available energy and average prices, we estimate average total price to be 15,5 cent / kWh
  - (availability is in Helsinki latitude maybe 7 months)

- What is the value of that saving (cash flow)?

- $$Value = \frac{Net\ operating\ income\ (NOI)}{Capitalization\ rate} = \frac{191221*15{,}5}{1\%} = 2\ 963\ 926\ €$$

Applying Discounted Cash Flow (DCF) Method would be better idea

- For a chosen fixed period (20 years?)
- But for simplicity we use direct capitalization
  - Outcomes could be quite close

Nowadays IVS talks about Gordon growth model…

$$P = \frac{D_1}{r - g}$$

where:

P = Current stock price

g = Constant growth rate expected for dividends, in perpetuity

r = Constant cost of equity capital for the company (or rate of return)

D_1 = Value of next year's dividends

Things to consider at this point

Yearly amount of produced energy will probably be quite stable in average

We believe that price of electricity wont stay at this level. This is based on the price history and different future scenarios. Both suggest strong increase.

- $$Value = \frac{Net\ operating\ income\ (NOI)}{Capitalization\ rate} = \frac{191221*15{,}5}{1\%} = 2\ 963\ 926\ €$$

Cap rate includes in the beginning only the estimated inflation rate =>
Nominal value => Real value

Often there are some kind of risk component and yield (requirement) included

First adjustments

- Cap rate (a buil-up method: IVS 50.31)
- Yield 5 %
- Risk premium 2 %
- Inflation 2%

- $$Value = \frac{Net\ operating\ income\ (NOI)}{Capitalization\ rate} = \frac{191221 * 15{,}5}{9\%} = 329\ 325\ €$$

We will next focus on the electricity price

- Quantitative approach => we will look backwards
- We try to capture the nature of the electricity price development
- We have monthly average of so called L2 electricity price
  - Time serie 09/2009 – 08/2021 (144 data points)
- We use the model: monthly $price_t$ = previous $price_{t-1}$ x e^r
- Where r is periodic monthly return $\ln(price_t/price_{t-1})$
  - Where r is expected to be normally distributed (and where r is in practice per cent)

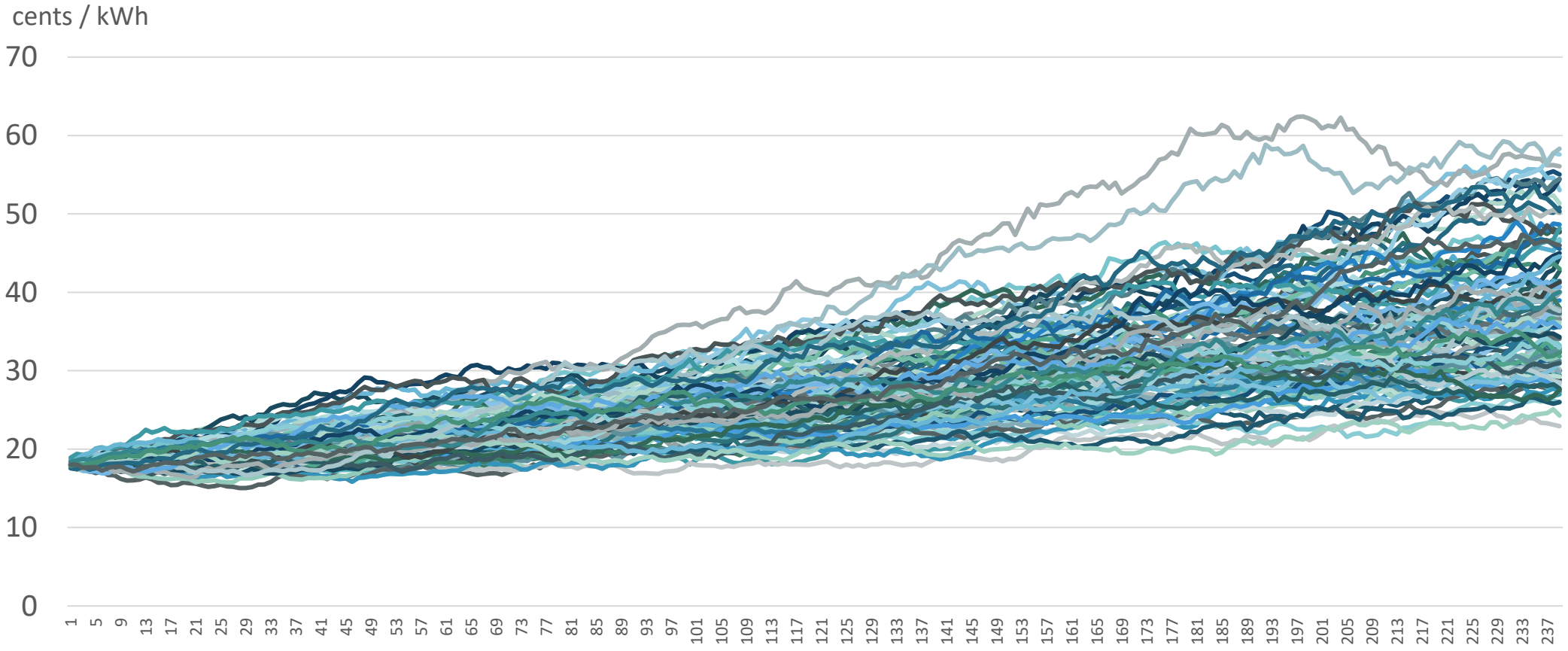
We get

- r ~ N(0,32% , 0,014^2)
- On yearly level we get 3,9%
- Hereby we calculate now
- $Value = \frac{Net\ operating\ income\ (NOI)}{Capitalization\ rate} = \frac{191221*15{,}5}{9-3{,}9\%} = 581\ 162\ €$

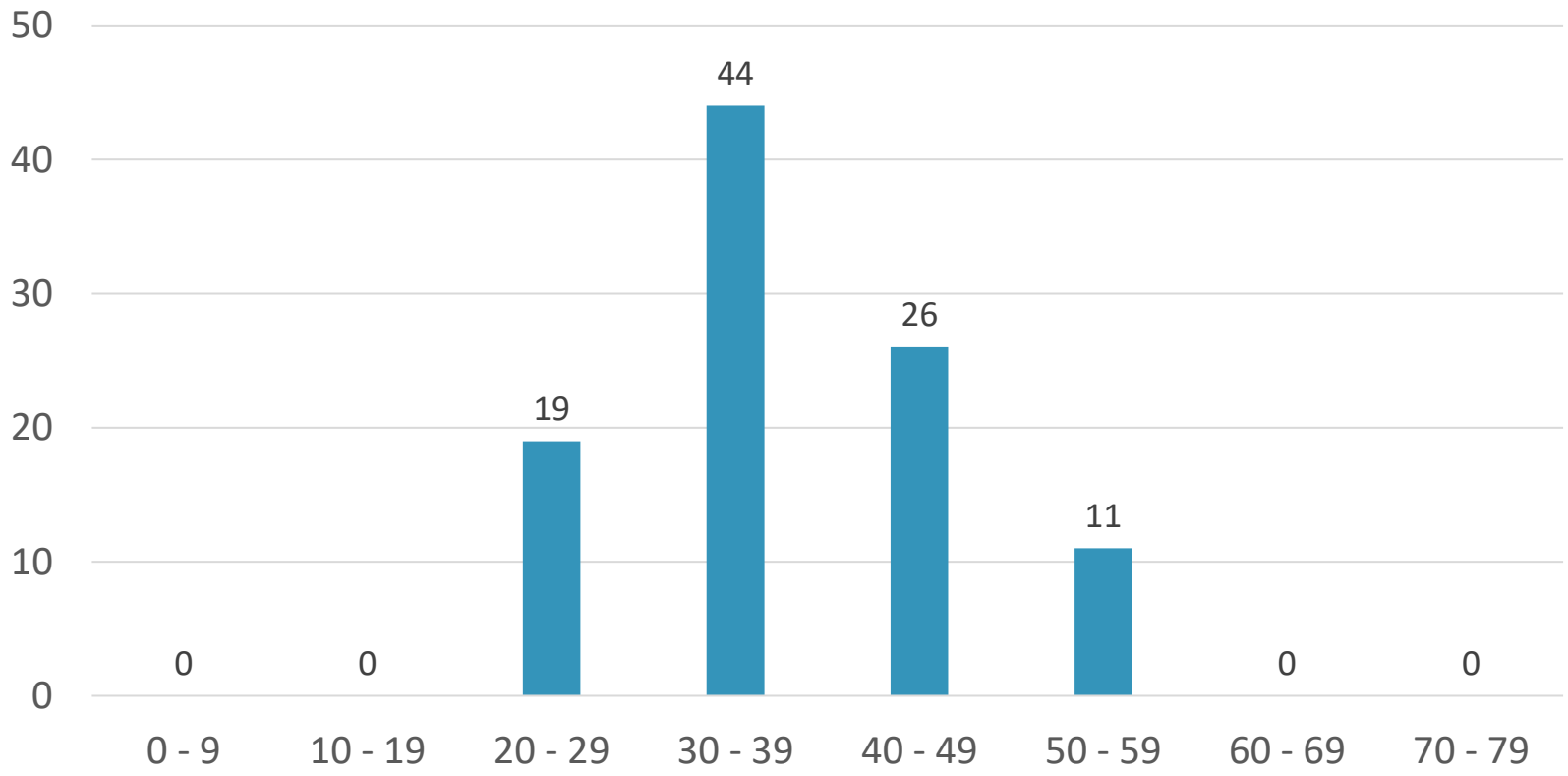
Are we done now?

- In case of real estate valuation we could even be
  - We have taken account time value of money, risk and yield requirement
- But it is possible to continue
- r ~ N(0,32% , 0,014^2)
- We can do a simulation, a Monte Carlo Simulation
- In practice we are asking, how probable it is that yearly electricity price increase is <u>not</u> +3,9 %
- Maybe it could be just 3%, e.g. How probable is that scenario and what might be the investment value be then?

One result of 100 simulations, 240 months ahead



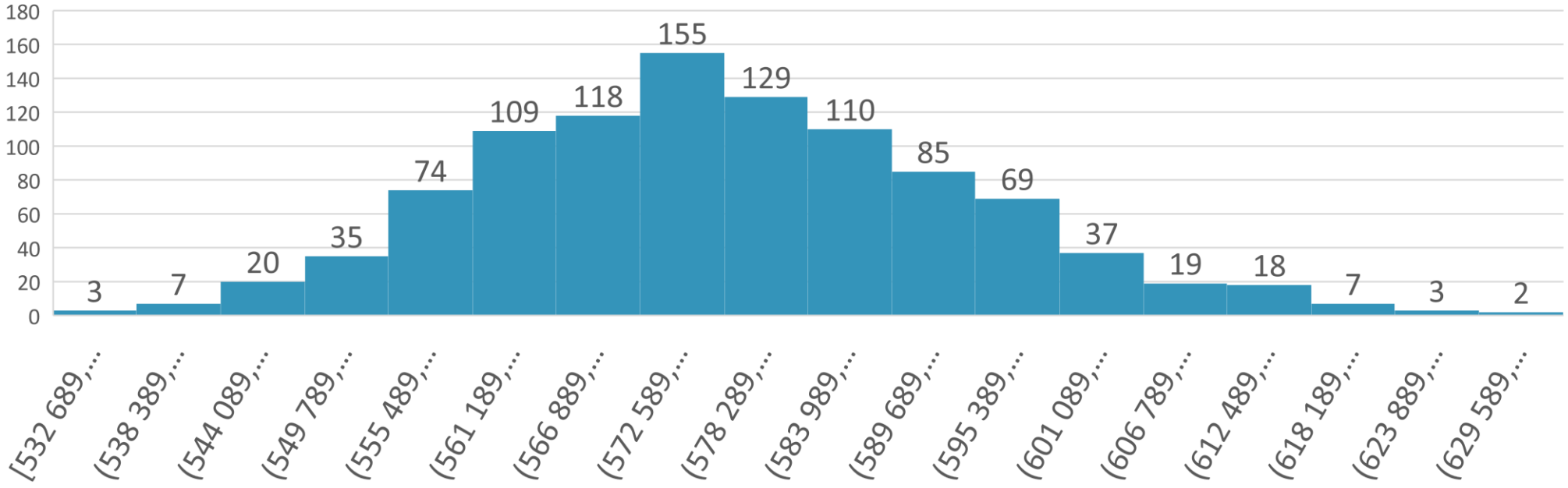
Results of 100 another simulations,240 months ahead



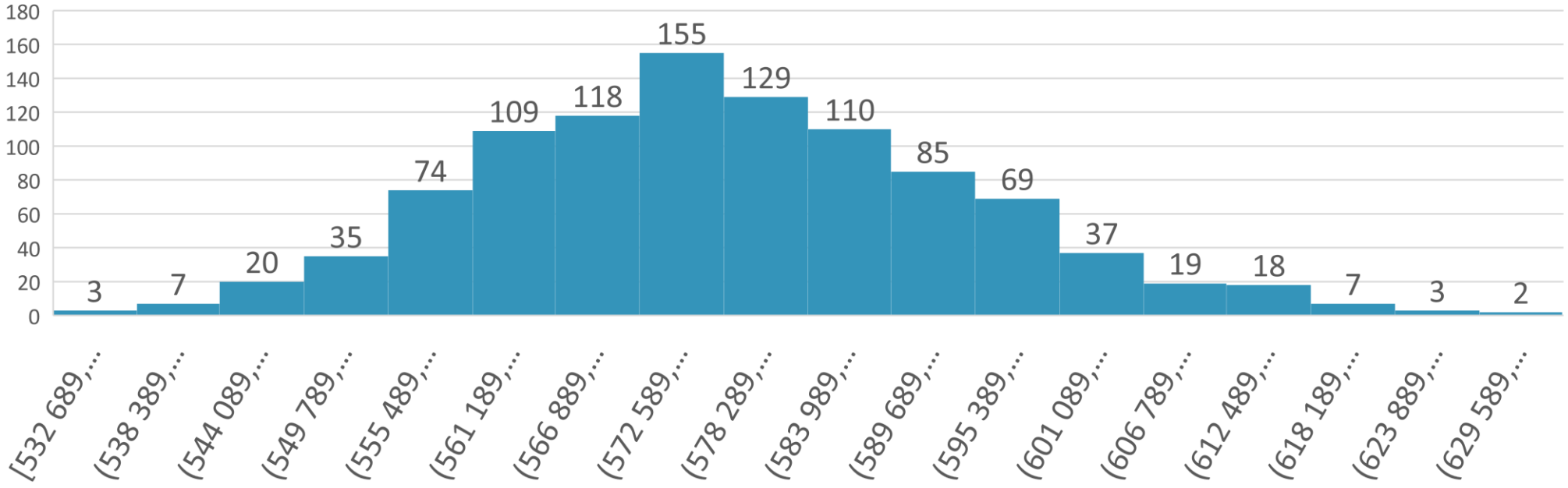
And we want to simulate the value calculation as well, 1000 times

- $Value = \frac{Net\ operating\ income\ (NOI)}{Capitalization\ rate} = \frac{191221*15{,}5}{9\% - N\sim(3{,}9\%\ ,\ 0{,}0069)} =$

And our investment value is…



Answering: it seems that true nature of investment value is a probability distribution



After finding the invest cost we can answer to to questions like…

- What is the most probable payback time?
- What is the probability that net present value of the investment is at least the investment cost?
- What is the probability that IRR is at least 10 %

Some critics

- This was a simplification, DCF (without terminal value) would have been more justified choice
- Monte Carlo simulation is a valid choice, if future is same than the past
  - We can know only afterwards was it
- Quantitative methods could/should be applied parallelly with qualitative methods (vice versa)

And basically nothing new there…

- Kummerow 2002, p.407:
  - "Value should be defined as "estimates of the parameters of the possible price distribution for the subject property as of a given date."
  - "Reporting measures of variation in distributions offers clients valuable information about risk and uncertainty."
  - "Reporting on price variance offers valuers a credible defence against professional indemnity claims in cases where sales occur at unusual prices that were low probability outcomes.
  - "The definition should also include forecasts of future possible values to help markets incorporate rational expectations and thereby improve efficiency."

THANK YOU FOR YOUR ATTENTION!

If you are interested in to participate a research project development related to future proofed concepts, please take a contact

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