Funding-Gap for Infrastructure Project in Masterplan Acceleration and Expansion of Indonesia Economic Development: A System Dynamics Approach

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Total investment in Indonesia until 2025, according to MasteIDRlan Acceleration and Expansion of Indonesia Economic Development 2011-2025 (MP3EI)(2010), is IDR 4,482 triliun or US$448 billion included infrastructure project IDR1,774 triliun. The composition of funders come from private 49%, government 12%, SOE 18%, and mix is 21%. But, actually after launching this program in 2011, MP3EI program has spent IDR737,9 triliun (16.5%) on October 2013. There are many constraints that caused this deceleration, one of them is funding-gap. Baker & McKenzie (2013) reported that in Middle East and Asia-Pasific, government-backed institutions often lent more than commercials banks on major projects, and they found that export credit agencies (ECAs) and development finance institutions (DFIs) had seen "exponential growth" since the start of the financial crisis is 2008.This paper examines why MP3EI program especially infrastructure projects in Indonesia as part of Asia-Pasific still slow and analyze it with use actual data then be forecasted until 2025 and 2045. Method that used to forecast funding-gap until 2025 and 2045 is system dynamics and how to interven it in order to remove or to minimize the funding-gap.

Keywords: infrastructure projects, Asia-Pasific, System Dynamics, export credit agencies, development finance institutions

1. INTRODUCTION

Indonesia has launched Master Plan Acceleration and Expansion of Indonesia Economic Development (MP3EI) 2011-2025 in 2011, where it plan IDR4,482 triliun or US$448 billion included infrastructure project IDR1,774 triliun. The executing development of MP3EI after been launching by President on May 27st 2011, after been validating by Commiittee of MP3EI on March 2013, showed that there are 209 projects or equivalent with IDR 603 Triliiun (14% total IDR4,482 Triliun) from for all of corridors.

The acceleration of MP3EI implementation for six corridors has been appointed to 1) to realize various economic development, inclusive, and sustain to all of Indonesia regions; 2) to implement MP3EI through breakthrough and business as not usual approach; 3) to positioning of Indonesia as a major player (top 10 advanced economies in the world by 2025 and world's top six by the year 2050).

To realize the objectives of Indonesia as one of the world's developed country by 2025, Indonesia expect per capita income of USD 14,250-USD 15,500 with total GDP of USD 4.0-4.5 Triliun, real economic growth of 6.4-7.5 percent which is expected for the periode of 2011-2014. The 2025's vision is achieved by focusing on 3 main golas: 1)

Increase value adding and expanding value chain for industrial production processes, and increase the efficiency of the distribution network; 2) Encourage efficiency in production and improve marketing efforts to further integrate domestic markets in order to push for competitiveness and strengthen the national economy; 3) To push for the strengthening of the national innovation system in the areas of production, process, and marketing with a focus on the overall strengthening of sustainable global competitiveness towards an innovation-driven economy (MP3EI, 2011, pg. 15).

In operating MP3EI concept and encouraging acceleration and expansion of Indonesia economic developement to all of Indonesia regions, every economic corridor has been identified amount of Investment Attantion Region (Kawasan Perhatian Investasi/KPI), is a collection of one or more investment activities in areas geographically adjacent agglomerated and supported by a network system infrastructure that will strengthen intra and inter-regional connectivity in the surrounding. Through the KPI approach is expected to support the provision of the necessary infrastructure is integrated with a variety of private and state-owned investment projects thatc an be provided efficiently and effectively. Of the152 pre-defined KPIs throughout the economic corridors, KP3EI Working Team has defined 80 (eighty) KPI priorities by considering the numberof validated projects, the value of a large investment, and also is the strategic national project.

Table 1. The development of Projects and Investment in Every Economic Corridor (Status until March 2013)

Economic Corridor	**Amount of Projects**	**Real Sector (IDR. Bio)**	**Amount of Projects**	**Infra-structure (IDR Bio)**	**Amount of Projects**	**HR and Tech Devl (IDR. Bio)**	**Total (IDR. Bio)**
Sumatera	52	551.133	219	422.126	67	4.107	977.366
Java	113	318.842	188	922.435	98	7.335	1.248.612
Kalimantan	55	740.823	102	165.610	34	1.676	908.109
Sulawesi	63	163.089	197	186.785	26	3.065	352.939
Bali – Nusa Tenggara	12	166.578	95	70.266	22	1.708	628.920
Papua and Maluku Islands	13	506.820	98	121.364	30	736	628.920
Total	**308**	**2.447.285**	**899**	**1.888.586**	**277**	**18.642**	4.354.513

Source: KP3EI Secretariat

National Connectivity is an integration of four (4) elements of national policy which consists of the National Logistics System (Sislognas), the National Transportation System (Sistranas), Regional Development (IDRJMN /RTRWN), as well as Information and CommunicationTechnology (ICT /ICT). In its development until the first quarter of 2013, infrastructure investment reached IDR. 1888.6 trillion from IDR. 1,786 Trillion at the time of launching the MP3EI the number of infrastructure projects 899 projects from 625 projects.

Table 2. Recapitulation valueof each Sector Infrastructure Investment

Sector	Amount of Investment (IDR. Bio)					
	Sumatera	**Java**	**Kalimantan**	**Sulawesi**	**Bali-NT**	**Papua-Maluku**
Port	23.835	36.547	14.750	18.527	1.463	59.481
AiIDRort	6.878	44.566	3.677	1.479	11.953	2.525
Railway	80.095	286.552	61.100	74.380	12.100	-
Road	64.327	187.483	35.153	16.938	29.217	20.035
Energy	195.194	293.210	29.791	33.726	9.316	3.460
Water Resources	2.110	28.731	635	7.569	1.493	315
ICT	49.670	45.318	20.504	33.830	4.664	35.448
Logistic		29	-	336	60	100
Total	**422.127**	**922.435**	**165.610**	**186.785**	**70.266**	**121.364**

Source: KP3EI Secretariat

Total investment in infrastructure is still dominated by the economicc orridors in the Western region of Indonesia, where there is a large amount of the investment in Java Economic Corridor of IDR. 922.4 trillion, followed by Economic Regions (KE) Sumatra IDR. 422.1 Trillion, TO Sulawesi IDR. 186.8 Trillion, KE Papua-Maluku Islands of IDR. 121.4 Trillion and the smallest value of investments contained in TO-NT Bali at IDR. 70.3Trillion.

Table 3. Recapitulation ofInvestment Value Based Sources of Funding Every Infrastructure Economic Corridor

Economic Corridor	**State Budget**	**State Owned Enterprise**	**Private**	**PPP**	**Mixed**	**Budget Need**	**Total**
Sumatera	109.111	98.845	115.222	61.614	36.326	1.008	422.127
Java	125.998	251.002	294.924	207.434	41.917	1.160	922.435
Kalimantan	29.052	37.418	25.635	57.861	14.775	870	165.610
Sulawesi	62.542	14.562	13.037	10.365	7.950	78.329	186.785
Bali-NT	7.562	12.417	4.250	45.496	42	500	70.266
Papua-Maluku	37.043	28.417	2.440	8.090	43.850	1.523	121.364
Total	**371.308**	**442.661**	**455.508**	**390.860**	**144.860**	**83.390**	**1.888.587**

Source: KP3EI Secretariat

In terms of sources of funding for infrastructure development in the whole corridor economy, still largely dominated by private investmentof IDR. 455.5 trillion (about24%), the state of IDR. 442.7trillion (about 23%), PPP is IDR. 390.86 trillion (about21%), and the state budget of IDR. 371.3 trillion (approximately 19.6%).

During the period of nearly two years since MP3EI launched on May 27, 2011, the implementation of MP3EI still faced with many obstacles and problems that occur in any economic corridor. The various problems and barriers, especially in infrastructure include those relating to land acquisition and source of funds.

The objective of this paper is to find the funding gap between Government Planning and Forecast Actual in MP3EI Infrastructure Sector using System Dynamics Approach.

2. METHODOLOGY

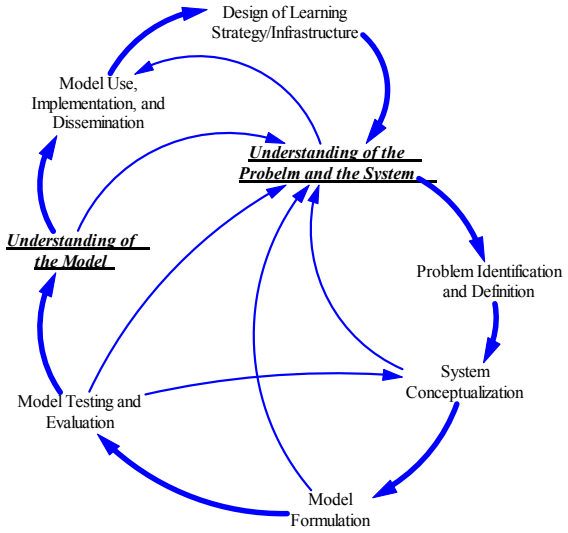
The methodology which is used to find the funding gap between Government Planning and Forecast Actual in MP3EI Infrastructure Sector is System Dynamics (SD) method. According to SD Society

> "System dynamics is a computer-aided approach to policy analysis and design. It applies to dynamic problems arising in complex social, managerial, economic, or ecological systems — literally any dynamic systems characterized by interdependence, mutual interaction, information feedback, and circular causality". (SD Society). ….the approach begins with defining problems dynamically, proceeds through mapping and modeling stages, to steps for building confidence in the model and its policy implications."

According to iSEE System,

> "The steps in Systems Thinking follow the framework associated with the iceberg image. At the simplest level, we want to describe the events, patterns, and structure associated with the problem or issue. EVENTS: What happened? PATTERNS: What's been happening? STRUCTURE: Why has this been happening? How can we explain the system's resistance to change? What are the implications for how we can intervene more effectively to create the results we want? Each step in Systems Thinking is described and illustrated in this module. We'll link the diagnostic process of describing the structure underlying the issue or problem to the process of crafting intervention strategies, implementing them, and using the results as further information to understand how the system is "wired together." …Then you'll practice using the tools introduced in the course to understand the structure of a problem or opportunity."

According to Martinez-Mayano and Richardson (2013) stages of system dynamics modeling process are: 1) conceptualization – problem identification and definition, system conceptualization; 2) formulation – model formulation; 3) Testing – Model testing and evaluation; 4) Implementation – Model use, implementation, and dissemination; 5) Design of learning strategy/infrastructure. Overview of the system dynamics modeling approach can be seen at figure 1.



Source: Martinez-Mayano and Richardson (2013)

Figure 1. Overview of the system dynamics modeling approach

3. LITERATURE REVIEW

The problem of financing a massive backlog in local infrastructure maintenance and renewal include across Australia, where the greatest source of financial difficulties seems to reside in ensuring adequate local infrastructure (Byrnes, Dollery, Crase, and Simmons, 2008).

According to Palma, Lindsey and Proost (2012) described that traditional revenue sources such as property and fuel taxes are unlikely to suffice in the future either to pay for adequate maintenance or to fund investments in new and improved infrastructure. Shortages of funds, and increasing support for the user pays principle, are behind calls to give an increased role to user charges such as highway tolls and air port fees related to congestion and other user-imposed costs. And the private sector is increasingly being called upon to help design, finance, build, operate and maintain infrastructure — often through Public Private Partnerships (PPPs).

According to Kekelekis (2011) concluded that the conditions under which public funding of infrastructure projects may not constitute State aid. In past practice, public funding of infrastructure was considered as a measure of general public interest. As recent practice reveals, the Commission's assessment has been elevated to a stricter level, irrespective of whether the public funding involves a PPP.

According to John (2012) described that during the financial crisis of 2008, private-sector debt has fallen by a massive amount, more than 9% of U.S. GDP, with most of the decline occuring in households (pg.86). And also, there was a limited approach to U.S. government support fot he capitalization of infrastructure porjects (pg.87).

In Australia, to overcome the financial gap in infrastructure projects, Macquarie Bank and subsequently adopted by a number of other investment banks and finance houses such as Babcock and Brown (Davis, 2009).

According to Dollery and Mounter (2010) in the Australian local government context, the problem of financial sustainability and its impact on local infrastructure hase been considered in several recent public inquires into the various state local government systems.

In order to become eligible for funding, local councils must a) demonstrate an infrstructure backlog; and (b) adopt an agreed asset management system. It must be stressed that the exposition of the proposed federal local infrastucture fund represents an initial at sketching both the need for such a fund and its operation (Dollery, Byrnes, Crase, 2007).

In South Africa, the problem of funding to finance infrastructure projects accured, Ruiters (2013) found that the South African Government has recognized that new delivery models are required to close the infrstructure funding gap to extend access to water and sanitation to communities who have long been neglected and are often far from existing infrastructure (pg. 322).

According to Forrester (2013) "system dynamics model can become a general theory of economic behavior. All behavior is endogenous. There are no exogenous driving variables, as are so often inserted into traditional econometric model. A strong growth trend in employment results from rising population. The model uses capital plant and people to produce goods. It has money flows, internally generated prices, monetary authority, movement of labor among sectors, and a household sector that buys, saves, and consumes the output of production."

Application of system dynamics to organizational problems continues to expand, both interns of numbers of projects. The project started in 2009, aiming to provide visibility for consulting projects that use system dynamics as a method. The goal has been to provide an online, free access collection of system dynamics consulting projects. For a case to be accepted it must meet the following three criteria: 1) it should be based on a contracted project (with funding or in-kind support) by a private of public organization; 2) it should have been published in a peer-reviewed journal, book, or conference proceedings in 1990 or after ; 3) it should report on a fully developed simulation modeling analysis (Rouwtte and Ghaffarzadegan, 2013).

4. MODEL STRUCTURE

Figure 2 shows a causal loop diagram summarizing the principal feedback captured by and the exogenous influence to the model.

The model is organized into infrastructure sector: total infrastructure development; budgeting from state budget MP3EI, Public Private Partnership (PPP), and Private; economic growth; and financial gap.

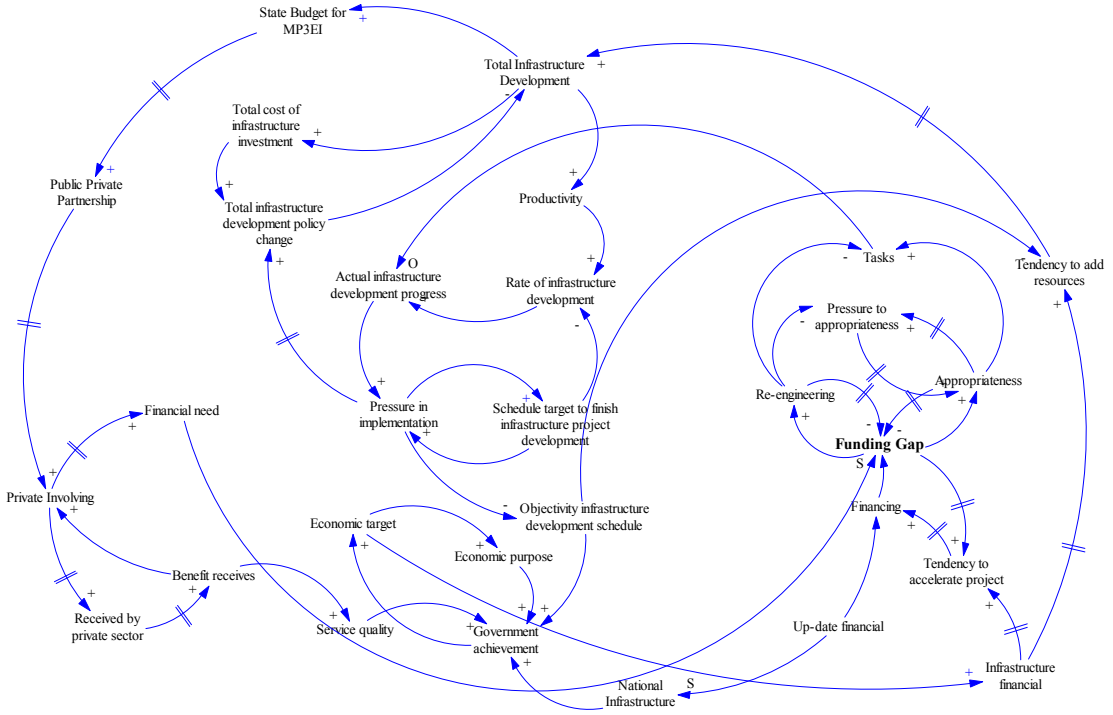


Figure 2. Overview of the model causal loop structure of Funding Gap for Infrastructure Project in MP3EI

Sources of fund for MP3EI Infrastructure financing comes from State Budget, State Owned Enterprise, Private, PPP, Mixed, and Budget Need (see Table 3). The stock from every source of fund uses exponential growth, because according to Baker & McKenzie (2013) reported that in Middle East and Asia-Pasific, government-backed institutions often lent more than commercials banks on major projects, and they found that export credit agencies (ECAs) and development finance institutions (DFIs) had seen "exponential growth" since the start of the financial crisis is 2008. So, every source of fund uses exponential growth as see at figure 3.

To compare sources of fund, we divide two concepts: first is sources of fund comes from Government Planning; and the second is simulation of sources of fund comes from other state budget MP3EI.

From figure 3, the equation of Rate of Total Budget Inf Sec from Total for Infrastructure Sector MP3EI which is planned by Government is:

Rate of Tot Bud Inf Change*Diff from Tot Budget to Tot Budget for Inf Needed (1)

Diff from Tot Budget to Tot Budget for Inf Needed:

Total Budget for Inf Needed-Total Budget for Infrastructure Sector MP3EI (2)

Total Budget for Inf Needed: 1888.6 IDR Triliun (3)

Rate of Tot Bud Inf Change : 0.35 percent (4)

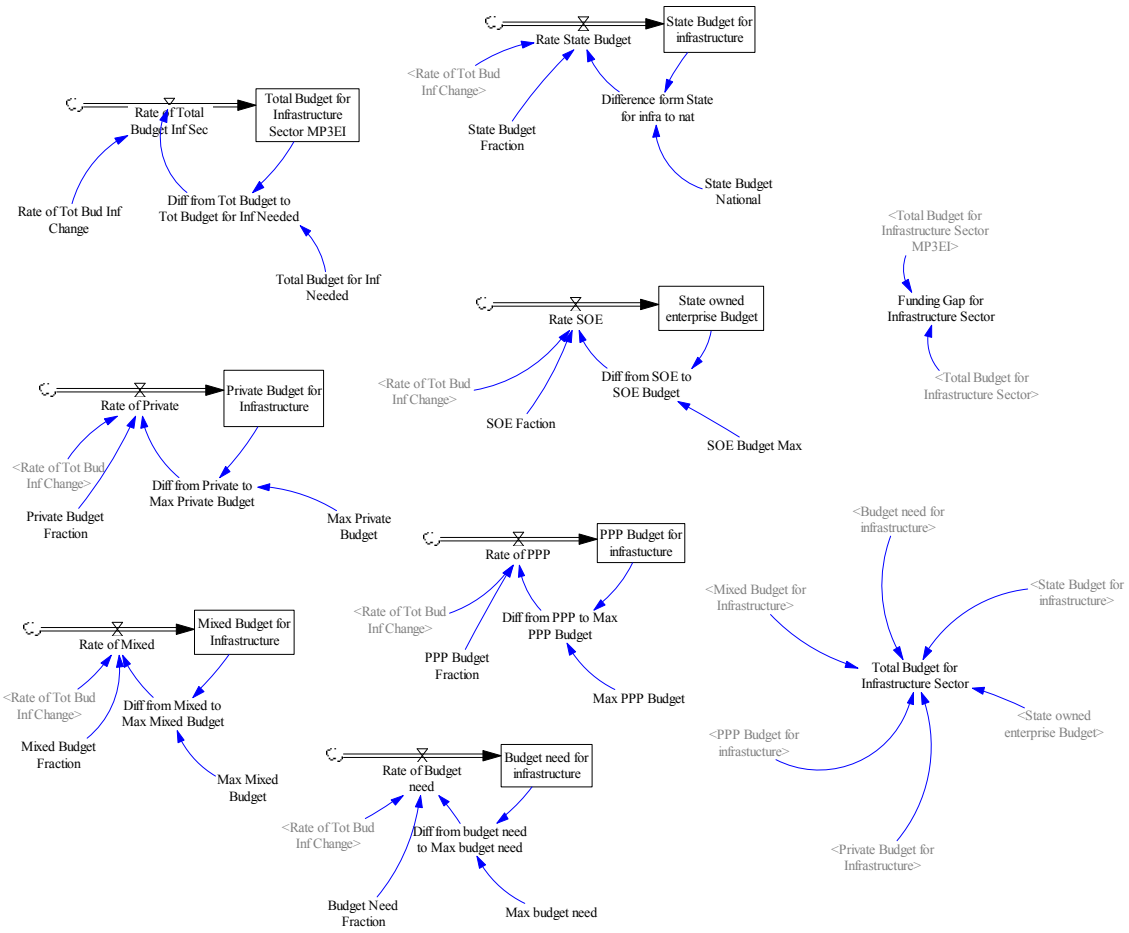


Figure 3. Stock and Flow diagram of Funding Gap for Infrastructure Project in MP3EI

Meanwhile the sources of fund comes from other state budget MP3EI, then calculates to every source of funds, such as: State Budget, State Owned EnteIDRrise, Private, PPP, Mixed, and Budget Need.

The equation of Rate State Budget from State Budget for infrastructure is:

Difference form State for infra to nat*Rate of Tot Bud Inf Change*State Budget Fraction (4)

Difference form State for infra to nat:

State Budget National-State Budget for infrastructure (5)

State Budget National: 371.308 IDR Triliun (6)

State Budget Fraction: 1 Dmlns (7)

With the same exponential growth system dynamics model, we can find the financial gap between State Budget MP3EI Planning and Sources of fund from the other where the gap funding can be calculated from the equations:

Funding Gap for Infrastructure Sector:

Total Budget for Infrastructure Sector MP3EI-Total Budget for Infrastructure Sector

(8)

Funding gap for infrastructure sector graph after using system dynamics approach can be seen at figure 4 below:

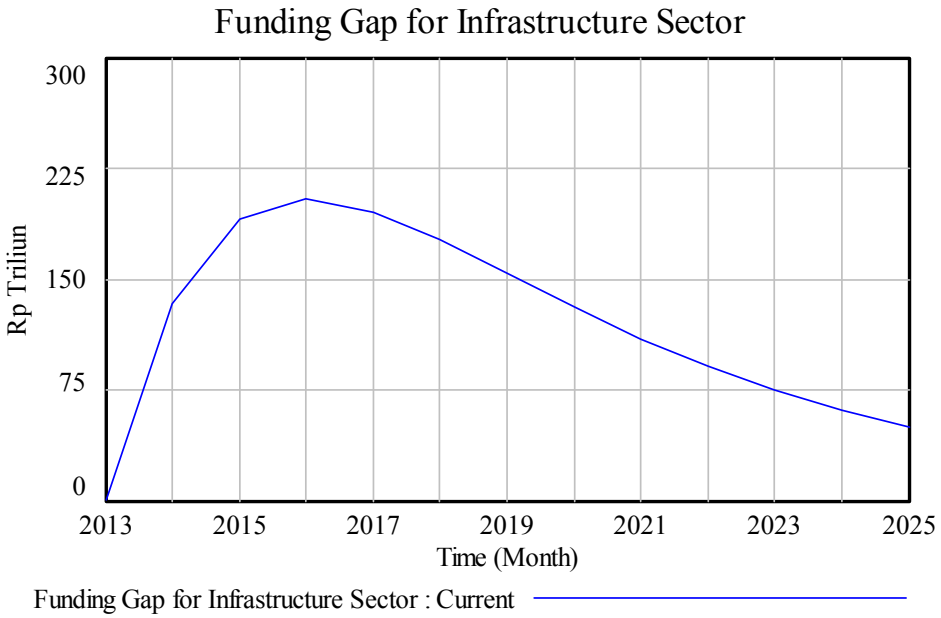


Figure 4. Funding Gap for Infrastructure Sector

From figure 4, the peak of funding gap can be seen between 2015 and 2015 is amount of IDR 204.019 Trilliun.

5. CONCLUSION

The conclusion of this paper can be summarized for some points, such as:

- Total Budget for infrastructure sector depends on rate of total budget infrastructure change
- Source of funds for infrastructure sector depends on fraction and rate of total budget infrastructure change
- The peak of funding gap between Total Budget for Infrastructure MP3EI (Government Planning) and Total Budget for Infrastructure Sector (SD Forecast) is amount amount IDR 204.019 Triliun (2015 – 2017)
- There is a potential funding gap that has to be filled by government
- If the progress acceleration is delay then the potential funding gap can be wider.

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