SBCM Field Theory: The General Equations of Regional Flux and the Control of Divergence

— From Meso-Economics to "Administrative Hydraulics": The Continuity Equation of Wealth —

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Abstract

In the previous studies (Part 1-3), we defined the "Standard Block" as a discrete unit and analyzed the "Distortion" (D_{index}) and "Leakage" ($1 - R_{block}$) of administrative measures. However, real-world economy behaves not as rigid blocks, but as a continuous fluid field where wealth flows, accumulates, and dissipates.

This study introduces the **"SBCM Field Theory,"** which applies the **Continuity Equation** of physics to regional economics. By defining the **Economic Density (**ρ**)** and **Economic Flux (**J**)**, we derive the **"Governing Equation of Regional Survival."**

The mathematical analysis reveals that the "Straw Effect" is equivalent to the **positive divergence (**

$\nabla \cdot J > 0$) of the economic vector field. We prove that without algorithmic flow control (**G-Cart Protocol**) to enforce **Mesh Refinement** of budget injection, any large-scale fiscal stimulus thermodynamically results in vacuum decay (economic collapse) of the local region.

1. Introduction: From Discrete Blocks to Continuous Fields

1.1 Limitations of Discrete Models

In Part 3, we defined the "Leakage Rate" (

$1 - R_{block}$) as a scalar value per block. While effective for static analysis, it fails to describe the **dynamic spatial flow** of wealth—how capital injected into a rural town instantly vaporizes and condenses in the capital city (Tokyo).

1.2 Objective: Administrative Hydraulics

We propose a paradigm shift from "Economics" to **"Administrative Hydraulics."** By treating money as an incompressible fluid and human activity as energy, we can describe the state of a municipality using partial differential equations. The goal is to establish the **"SBCM Governing Equation"** that universally describes the accumulation and dissipation of local wealth.

2. The SBCM Governing Equation

2.1 Definition of Field Variables

We define the following variables at coordinate

x and time t:

- **Economic Density ($\rho(x,t)$):** The concentration of wealth and vitality per unit area (Stock).
- **Economic Flux ($J(x,t)$):** The flow vector of wealth (Flow). Defined as $J = \rho v$, where v is the velocity of money circulation.
- **Source/Sink Term ($\sigma(x,t)$):** The net generation or consumption of value within the point.

2.2 The Continuity Equation

Applying the law of conservation to the regional economy, we derive the fundamental equation:

$$\frac{\partial \rho}{\partial t} + \nabla \cdot J = \sigma$$

This equation states that "**The change in local wealth (**

$\frac{\partial \rho}{\partial t}$**) is determined by the balance of internal value generation (σ) and the spatial divergence of wealth ($\nabla \cdot J$).**"

3. Physical Interpretation of Terms

3.1 The Divergence Term: $\nabla \cdot J$ (The Straw Effect)

The operator

$\nabla \cdot J$ (Divergence) represents the scalar rate of "outflow" from a point.

- $\nabla \cdot J < 0$ (**Convergence**): Wealth flows into the region and circulates. (Ideal State)
- $\nabla \cdot J > 0$ (**Divergence**): Wealth leaks out to external entities.

The "SBCM Straw Effect" defined in Part 3 is mathematically expressed as a state of **High Positive Divergence**.

3.2 The Source Term: $\sigma = S - L$

The generation term

σ is composed of:

1. **Source (S):** Value creation by internal actors.
    - **Labor Source(S1):** Value generated by human capital/community work.
    - **Energy Source(S2):** Value generated by local renewable energy/resources.
2. **Loss (L):** Systemic dissipation.
    - Maintenance costs of infrastructure, administrative overhead, and intermediate exploitation (middlemen).

4. The Theorem of Leakage Rate (λ)

Why does positive divergence occur? It is a function of the **mismatch between Input Scale and Capacity**.

We define the Leakage Rate

λ:

$$\lambda = f(\frac{I_{budget}}{C_{capacity}})$$

- I_{budget} : Budget size of the project.
- $C_{capacity}$: Execution capacity of local SMEs.

Theorem 1: The Limit of Massive Injection

$$\lim_{I_{budget} \gg C_{capacity}} \lambda \to 1.0$$

Proof: When a project's scale exceeds local capacity (e.g., a 10 billion JPY stadium in a village of 5,000), local entities cannot bid. The contract is inevitably awarded to a General Contractor in the capital. Thus, the flux vector

J aligns instantly toward the outside, causing $\nabla \cdot J$ to maximize.

Conclusion: "Macro-stimulus packages in depopulated areas mathematically result in zero retention."

5. Engineering Solution: Mesh Refinement via G-Cart

To solve

$\frac{\partial \rho}{\partial t} \geq 0$ (survival), we must minimize $\nabla \cdot J$.
Since $C_{capacity}$ (local capability) cannot be increased instantly, we must control I_{budget} .

5.1 The G-Cart Protocol (Flux Controller)

We introduce **"G-Cart,"** an algorithmic procurement protocol that acts as a "meshing tool" for the budget.

- **Function:** It automatically decomposes a large vector I_{budget} into a set of smaller vectors $\{i_1, i_2, \ldots, i_n\}$ such that:

$$\forall k, \quad i_k \leq C_{capacity}(x)$$

- **Result:** By satisfying the capacity constraint, the Leakage Rate λ approaches 0, shifting the state from **Divergence** to **Circulation**.

5.2 Maximizing the Functional

The ultimate goal of SBCM Field Theory is to maximize the following functional over the region

Ω:

$$\text{Maximize } J[\rho] = \int_{\Omega} (S_{Labor} + S_{Energy} - L_{maint} - \nabla \cdot J) dV$$

This equation dictates the new rules of governance:

1. **Maximize Source:** Utilize Human Capital and Energy Capital.
2. **Minimize Loss:** Automate administration to reduce overhead (L).
3. **Zero Divergence:** Use "G-Cart" to prevent the Straw Effect.

6. Conclusion

SBCM Part 4 completes the theoretical transition from "Static Statistics" to "Dynamic Field Theory."
We have proven that the poverty of regions is not a lack of money, but a **structural high-divergence field configuration**.

The solution is not to pour more water (Tax) into the leaking bucket, but to install a **Fluid Control System (G-Cart)** that matches the flow rate to the block's capacity.

References

1. Koyama, H. (2025). *Proposal for the Standard Block Comparison Method (SBCM)*. Zenodo. doi.org/10.5281/zenodo.17766254 (http://doi.org/10.5281/zenodo.17766254)

2. Koyama, H. (2025). *SBCM Economics Part 2: Dynamic Meso-Economics*. Zenodo. doi.org/10.5281/zenodo.17777745 (http://doi.org/10.5281/zenodo.17777745)

3. Melnus. (2025). *G-Cart: The Virtual General Contractor System*. GitHub. https://github.com/Melnus/Virtual-General-Contractor (https://github.com/Melnus/Virtual-General-Contractor)