

How Can Productivity in Research and Development Be Improved

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1. Rapidly Changing Age

Society and the economy are undergoing significant changes, including a rapidly aging population with a declining birth rate, frequent accidents and disasters, global environmental issues becoming obvious and fiercer global competition. Technological innovation, including artificial intelligence, robots, and IoT, is also accelerated. In the field of housing and infrastructure, I have the impression that more sophisticated and complex research and development are wanted in a shorter period of time.

How can we respond to the needs with limited budgetary, organizational, and human resources? I would like to show an actual example and discuss a method of improving productivity of research and development.

2. Applying Front-Loading Practice to Research and Development

Recently, we hear the phrase “front loading” very often. This concept would apply to research and development. It is more important than ever to clarify the concrete picture of the application of the research result to society and its effect, draw relationships and paths between research elements (whole picture of the research), map out a schedule, and consider the distribution of human and capital resources in the planning phase.

3. Concrete Measures Found in an Actual Example

The above processes of work are very hard in actuality and it is essential to use our ingenuity for

research management. Let us show you concrete measures, using my experience as a sample.

1) Understand the basic flow of research

Although the research itself is not a routine task, there are common fundamental procedures. The flow of extracting issues, formulating a hypothesis (research theme), verifying it with experiments or simulations (facts), and reaching a conclusion is considered applicable to many research studies.

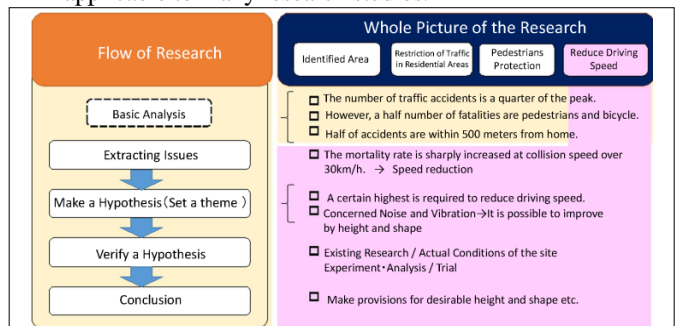


Figure 1: Fundamental Flow of Research and an Example of Positioning of Themes

2) Overlooking and sorting out the themes from a higher point of view and reconfirming their positioning

The meaning of the research and related issues to be discussed will become more evident if you overlook the themes from a higher point of view, sort them out, and

種類と性能	規定する項目と性能	規定のポイント(1) 実態 (自治体の設置等)		(2) 海外の基準 (基準の再考、規定の内容等)		(3) 分析・実験データ	
		A 現状あり	B 現状あり	A 現状あり	B 現状あり	A 現状あり	B 現状あり
性能: 合部を通過する車両を一時的に角上げするものであり、事前にこれを確認した運転者が速度を落とす必要を促す構造とする。	規定する項目と性能	2~33%	5%未満 (最多)	ドイツでは10~14%を推奨(入国路では4%以上)	4%以上 (歩)	平均勾配5%・サイン曲線・高さ10cm・形状	平均勾配5%・サイン曲線・高さ10cm・形状
性能: 傾斜部の勾配が歩行者、自転車、自転車の安全な通行の妨げとならず、通過する車両に大きな衝撃を与えないように設計する。	傾斜部の勾配	2~33%	5%未満 (最多)	イギリス、アメリカ 4~5%を推奨	4~5%	平均勾配5%・サイン曲線・高さ10cm・形状	平均勾配5%・サイン曲線・高さ10cm・形状
性能: 速度抑制効果が車間が詰つかないか。	速度抑制効果	2~33%	5%未満 (最多)			平均勾配5%・サイン曲線・高さ10cm・形状	平均勾配5%・サイン曲線・高さ10cm・形状
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Figure 2: Sample of Classifying Existing Researches and Domestic and International Cases and Clarifying Our Research Areas

reconfirm their positioning instead of being merely faithful to government policy or the set research theme or responding to a request from the field.

The right side of Figure 1 is an example of the “Technical Standard for Setting Bumpers and Creating Narrowed or Bent Parts” issued as a notification from the Director-General of the Road Bureau in March 2016. This standard is designed to specify the shape of the facilities to reduce driving speed as a measure against traffic accidents on roads in residential areas. However, speed reduction is not the only method. More measures can be taken on-site if it is combined with such approaches where only a very limited number of cars are allowed on the roads in residential areas, and the areas that need measures are easily identified on a scientific basis. The standard was mapped out, while sorting out the options of other measures and research items shown in the upper right of Figure 1 and paying clear attention to their positioning.

3) Clarifying the target you should focus on

It might be ideal if you could verify everything. However, you have a physical limit. By appropriately narrowing the targets you focus on, you may produce results efficiently. Knowing and understanding previous research studies, the actual conditions of the site and cases in other nations are meaningful from the viewpoint of productivity.

Figure 2 is an example of tabulation where the above items of the technical standard are compiled. By extracting the areas that cannot be explained or verified by the existing data and putting energy into them in the course of research, we could reach a conclusion in a short period of time. Sorting out and making clear the provisions and points of view must be a starting point of research and is also extremely important.

4) Obtaining external support and considering how to obtain it

We have been promoting a liaison with outsiders in such forms as joint research or outsourcing research studies. In recent years, however, it has become very difficult to cover all related technologies only within the scope of knowledge we have. As a countermeasure, new processes, such as accepting and trying technical

proposals from private sectors, social experiments, and study groups with academia, started in the field of Intelligent Transport Systems (ITS). It is necessary to consider and improve how we liaise to keep up with new technologies, while securing fairness and transparency.

5) Considering the role as a national research institute

New technologies are proposed in a wide variety of fields. However, it is not verified in many cases whether they have a real possibility of being effective at an actual worksite. Disaster detection technologies are also in the same condition. NILIM is sorting such facts as responses on the site and obtained information and promoted research in a technology that supports more rapid and accurate responses (Figure 3).

This approach has two key areas. One is sorting out and making clear the needs and requirements for the information based on reality (time required, accuracy, covered areas, and constraint like weather) as the strength of the Ministry of Land, Infrastructure, Transport and Tourism is Regional Development Bureaus and researchers who know the real site. The other is to improve the evaluation criterion instead of evaluating individual technology one by one. This is a trial to consider the characteristics of the NILIM and allocate the research resources to them efficiently.

4. Conclusion - Capturing Essence and Utilizing Discussion

So far, I have discussed a method to improve productivity in research and development. I would be grateful if the method were helpful to people outside of NILIM as well.

However, I would like you to avoid merely copying a style. Be sure that you understand the essence, arrange it depending on the characteristics of research, and spend time and energy on thinking by yourself. Note that discussions and coordination with persons concerned are also important ways to improve productivity. Be aware that opinions from people who have different knowledge, experience, specialties, and values may include wisdom you cannot obtain by yourself and a hint to resolve a bottleneck.

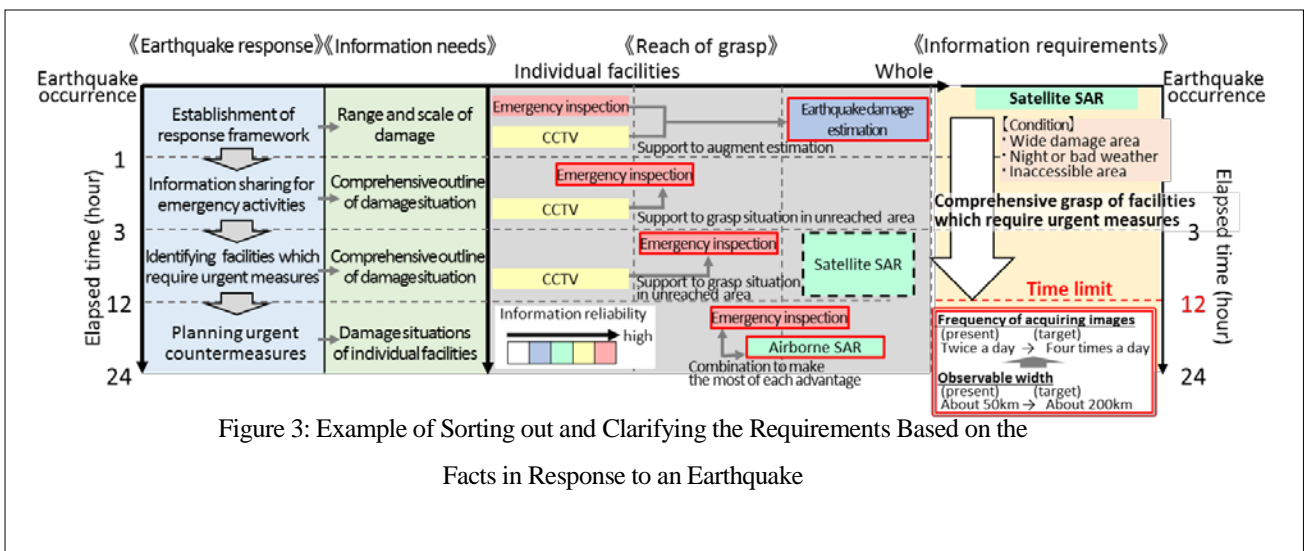


Figure 3: Example of Sorting out and Clarifying the Requirements Based on the Facts in Response to an Earthquake