

# Basic Research and Its Importance to Enhance Fundamental Knowledge in Resources and Environment Friendly Technological Advancement: The Holy Qur'anic Prescription

Md. Sirajul Islam \*, Sofiah Samsudin \*\*

\* PhD candidate, Department of Qur'an & Sunnah Studies, Kulliyah of Islamic Revealed Knowledge and Human Sciences, International Islamic University Malaysia, 53100 Jalan Gombak, Kuala Lumpur, Malaysia.

\*\* Assistant Professor, Department of Qur'an & Sunnah Studies, Kulliyah of Islamic Revealed Knowledge and Human Sciences, International Islamic University Malaysia, 53100 Jalan Gombak, Selangor, Kuala Lumpur, Malaysia

DOI: 10.29322/IJSRP.10.10.2020.p10693

<http://dx.doi.org/10.29322/IJSRP.10.10.2020.p10693>

**Abstract-** This article emphasizes on basic research which is a basic foundation of research and development. As results, the article has found that basic research is groundwork in attaining fundamental knowledge about natural, social and human ecosystems, a unique method to enhance basic knowledge about resources and natural phenomenon. It leads to generate innovative idea, to formulate theory that emphasizes on knowing and analysing the laws of nature as well as the divine creativities in creating biodiversity and natural resources. In fact, today's achievements, technological advancement, emergence of new technologies are grants of successful basic research. Definitely, scientists rely on the results of basic research to continue and sustain applied research in order to solve problems and develop new technology. In addition, motivation and funding in conducting basic research means deposit, expectation and waiting for inevitably pivotal results for surviving in future.

**Index Terms-** Basic research, pure research, theory, type of research, resources, environment, technological advancement

## I. INTRODUCTION

In the 20th century, both Bernal (1939) and Bush (1945) pointed at the importance of basic science for national security, health and economic growth and emphasized on the potential economic impact of investments in science<sup>1,2</sup>. The importance of Bush's

pivotal report science: The endless frontier cannot be overestimated, because it was the guide to capture the scientific momentum of the Second World War and transfer it into the paradigm for post-war science policy<sup>3, 4</sup>. By doing this, Bush introduced the terms of inquisitiveness driven basic research and use or product directed applied research. This distinction take place the grounds for the linear model of innovation and legitimated the public involvement in basic science funding<sup>5, 6</sup>.

Definitely, basic research plays an utmost role to a substantive contribution to the productivity development of the economy<sup>7</sup>. If we look at research grants, we see most big amount grants have been provided in basic research. For example, in the United States, the federal government in the years since the Second World War has provided the huge majority of all funds devoted to basic research<sup>8</sup>.

In fact, the distinction between basic and applied research then seems enormously to be whether a practical or a purely intellectual, academic, rational as well as scholarly results is the conscious goal of contribution. The discovery of new information such as new laws of nature, which eventually benefits mankind almost all over the modern world, is more likely to arise from basic than from applied research. However, fundamental discoveries that change basic physical laws are so rare that these events are hardly useful either as a distinction between basic and applied research or as a justification for support of basic research<sup>9</sup>.

<sup>1</sup> Neumann, M., 2014. External Effects of Basic Research Infrastructure (No. PUBDB-2015-04244). European XFEL.

<sup>2</sup> Lundvall, B.-A. and S. BORRÁS, 2005. "Science, technology and innovation policy". In: The Oxford handbook of innovation. Oxford University Press.

<sup>3</sup> Neumann, M., 2014. External Effects of Basic Research Infrastructure (No. PUBDB-2015-04244). European XFEL.

<sup>4</sup> Stokes, D. E., 1997. Pasteur's Quadrant: basic science and technological innovation. Brookings Institution Press.

<sup>5</sup> Neumann, M., 2014. External Effects of Basic Research Infrastructure (No. PUBDB-2015-04244). European XFEL.

<sup>6</sup> Pielke JR, R., 2010. "In Retrospect: Science - The Endless Frontier". In: Nature 466.7309.

<sup>7</sup> Rosenberg, N., 2010. Why do firms do basic research (with their own money)? In Studies On Science And The Innovation Process: Selected Works of Nathan Rosenberg (pp. 225-234).

<sup>8</sup> Rosenberg, N., 2010. Why do firms do basic research (with their own money)? In Studies On Science And The Innovation Process: Selected Works of Nathan Rosenberg (pp. 225-234).

<sup>9</sup> Dessler, A. J., 1969. The role of basic research in universities. Eos, Transactions American Geophysical Union, 50(9), 508-511.

Material and natural data of basic research are natural resources. The divine message regarding natural resources in the holy Qur'an. Almighty Allah says, "He it is who has created for you all that is on earth" (Al-Qur'an 2: 29). The verse informs all resources are beneficial and playing important role in natural ecosystem. Basic research is the best method to discover unique information and facts in resources. Hence, importance of basic research always demandable. There is no any possibility to underestimate the basic research. It is not only research but also a foundation of research and its methodology forever in the research world.

## II. CONCEPT OF BASIC RESEARCH

The foundation of research generally has been established on two levels: basic level and applied level. Trevers has defined basic level as basic research. "Basic Research is designed to add to an organized body of scientific knowledge and does not necessarily produce results of immediate practical value"<sup>10</sup>.

In addition, basic research has been defined by the National Science Foundation (NSF) as "original investigation for the advancement of scientific knowledge which does not have immediate commercial objectives"<sup>11</sup>. Such a research is time and cost intensive<sup>12</sup>.

Moreover, research and development (R&D) consists of three main activities: basic research, applied research, and development. Basic research is where it all starts: new ideas, fundamental theories, unanswered questions, and investigation into something that does not quite make sense. The basic researchers have been motivated by curiosity, motivation and a desire to explore unknown territory to reveal basic information and facts. Some ideas have been developed, some do not, and that is all part of the process. This research includes theoretical research, but it also includes early-stage examinations, investigations, recognize in the laboratory or field<sup>13</sup>.

The results of basic research are not generally sold but are usually published in peer reviewed scientific journals according to the scope of publication. Generally, in basic research, scientists have some freedom to set their own goals based on the research subject and duration of research project. Such research is usually

performed in the higher education sector but also to some extent in the government sector<sup>14</sup>.

Basic research is the research to find the basic and fundamental knowledge or to refine the basic knowledge. The main purpose of this research is enhance our understanding by attaining pure knowledge about all subjects, issues, facts, resources and so on.

## III. OTHER TERMS OF BASIC RESEARCH

Basic research also called pure research or fundamental research<sup>15</sup>. This type of research tends not to be directly applicable to the real world in a direct way, but enhances our understanding of the world around us. Pure research can be exploratory, descriptive or explanatory<sup>16</sup>.

Researchers conduct this form of research for human welfare, animal welfare and plant kingdom welfare and so on. The main motivation here is to expand man's knowledge by discovering, not to create or invent something for commercial purpose<sup>17</sup>.

Only depend on laterally meaning of basic, pure and fundamental create misunderstanding about this research and its status, essentiality and importance. An adequate study in literatures of basic research enable to profound understanding the rationality of named this research as basic, pure and fundamental research.

## IV. FORMULATING HYPOTHESES, THEORIES AND LAWS TO ADVANCE IN SCIENTIFIC KNOWLEDGE

Basic research analyses properties, structures and relationships with a view to formulating and testing hypotheses, theories or laws<sup>18</sup>. Pure research has the scientific research aim<sup>19</sup> to improve scientific theories for improving understanding or prediction of natural or other phenomena<sup>20</sup>. It is a research which generates new ideas, principles, philosophies and theories in different fields of knowledge<sup>21</sup>.

According to Nelson, R. R. (1959) the significant advances in scientific knowledge, the types of advances that are likely to results from successful basic research projects, very often have

<sup>10</sup> Singh, Y. K., 2006. Fundamental of research methodology and statistics. New Age International.

<sup>11</sup> Mansfield, E. 1980. Basic research and productivity increase in manufacturing. The American Economic Review, 70(5), 863-873.

<sup>12</sup> Singh, R., 2017. Research and Its Types.

<sup>13</sup> Richard Gross, Kimberly Jackson, Ranjit Koodali, 2019. Basic Research, American Chemical Society, <https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/basic-research.html>. Retrieved 19 February, 2019.

<sup>14</sup> Gulbrandsen, M., & Kyvik, S., 2010. Are the concepts basic research, applied research and experimental development still useful? An empirical investigation among Norwegian academics. Science and public policy, 37(5), 343-353.

<sup>15</sup> Saslow, C. A., 1982. Basic research methods. Addison-Wesley Publishing Company.

<sup>16</sup> Bhome, S. M., Prajapati, N., Deshmukh-Ghate, D., & Ghosh, A., 2015. Research Methodology (Tools and Analysis), Himalaya Publishing House.

<sup>17</sup> Singh, R., 2017. Research and Its Types.

<sup>18</sup> Gulbrandsen, M., & Kyvik, S., 2010. Are the concepts basic research, applied research and experimental development still useful? An empirical investigation among Norwegian academics. Science and public policy, 37(5), 343-353.

<sup>19</sup> Saslow, C. A., 1982. Basic research methods. Addison-Wesley Publishing Company.

<sup>20</sup> Vafadar, A., & Ghadimvand, N. K., 2016. Advanced research approach.

<sup>21</sup> Bhome, S. M., Prajapati, N., Deshmukh-Ghate, D., & Ghosh, A., 2015. Research Methodology (Tools and Analysis), Himalaya Publishing House.

practical value in many fields. Consider the range of advances resulting from Boyle's gas law or Maxwell's equations. On Gibbs' law of phases rests the design of equipment in fields as diverse as petroleum refining, rubber vulcanization, nitrogen fixation, and metal ore separation. Few firms operate in so wide a field of economic activity that they are able themselves to benefit directly from all the new technological possibilities opened by the results of a successful basic research effort<sup>22</sup>.

Basic research is a method to develop philosophy and formulate theory, and to examine and anatomize the legitimacy of developed philosophy, and validity of formulated theory. Acquired pure and fundamental knowledge by basic research can justify and recognize between true and fabricated theory, and assay beliefs and traditional notions. Profound understanding about laws of nature by basic research demonstrates with valid arguments existence of the Creator clearly, and purpose of creating human, and motive of creating resources and so on.

## V. BASIC RESEARCH TEAM

Basic research projects usually involve teams. These can include a primary investigator and his or her students and postdocs, groups of researchers from same discipline, or researchers from several interrelated disciplines. Teams may involve with researchers in many locations around the world, communicating by videoconference and sharing data using online collaboration tools. For example, chemists may work with materials scientists, biologists, geologists, physicists, or medical doctors. They may also enlist the help of computer scientists, engineers, and instrument design specialists to help them develop the new capabilities they need<sup>23</sup>.

In addition, the basic research team is usually working on the frontiers of knowledge<sup>24</sup>. In conducting basic research in medical the basic research team collaborates with the clinical team to determine scientific relevance within the context of human health and disease, and practicalities in terms of sample collection, storage and handling as well as sufficient laboratory resources to perform the assays<sup>25</sup>.

Another collaboration is that between the clinical research team and the basic research team; everyone has different expertise, and without teamwork it is difficult to continue in-depth research, especially if the subject is seeing rapid progress, such as lung cancer study, many mechanisms need to be explored<sup>26</sup>. The basic research team includes the principal investigator, sub-investigators, and clinical monitors<sup>27</sup>.

In addition, there are enormous outstanding basic research have been done individually. Basic research individually or teamwork depend on subject, issue, project, area and goal and form of basic research. Generally, basic research project cannot be conducted individually. Similarly, issue or subject that need individual attention, examination, scrutiny, observation then anatomize the experience, collectively research in such issue or subject will not find expected pure results. However, it can be conducted research in same subject or issue by 5 or 10 or 20 or more individual researchers. Then can be compered and again evaluate 20 results of 20 individual researchers in a same subject to find various understandings, interpretations and information from a same subject or issue. Based on results and comprehend further philosopher and scientists formulate theory and identify laws of nature, cause and effect of a fact. These experiences might motivate and help to undertake further project and agenda in order to be successful in sustainable development by resource management.

## VI. IMPORTANCE OF THE BASIC RESEARCH IN RESOURCES AND TECHNOLOGICAL ADVANCEMENT

Basic research launched to affect technology significantly in the period beginning around 1900 with the introduction of the results from basic chemistry research. Electromagnetism, solid-state physics, and nuclear physics followed with dramatic impacts that have been documented repeatedly and convincingly. Thus, since starting around 1900, generally we see, acknowledge and appreciate the crucial contribution that basic research did indeed produce a rapid series of benefits for society. It is reasonable to state that nearly all of the technological achievements of our society rest solidly on a foundation of basic research<sup>28</sup>.

There are many examples on importance of the basic research. Moishe Pripstein and George Trilling gave an example among many, they stated that when the theory of quantum mechanics was introduced in the 1920s, it seemed to many people to have no relevance at all to the macroscopic world, and therefore to our lives. As a physical theory of the sub microscopic world, quantum mechanics is applicable only to the world of very small distances. But within two decades, quantum mechanics led to the invention of the transistor and the development of solid-state electronics, which dominate our lives today. No one could have

<sup>22</sup> Nelson, R. R., 1959. The simple economics of basic scientific research. *Journal of political economy*, 67(3), 297-306.

<sup>23</sup> Richard Gross, Kimberly Jackson, Ranjit Koodali, 2019. Basic Research, American Chemical Society, <https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/basic-research.html>. Retrieved 19 February, 2019.

<sup>24</sup> Hill, K. M., Brookes, L. G., & Hunt, H. 1969. How much basic research is enough?. *Long Range Planning*, 1(3), 38-43.

<sup>25</sup> Chowdhury, F., & Williams, A. 2009. From research to regulated: challenges in transferring methods. *Bioanalysis*, 1(2), 285-291.

<sup>26</sup> Zhang, K. P., & Ma, L. 2017. Prof. Yun Fan: persistence guarantees expertise, patience conquers difficulties. *Journal of thoracic disease*.

<sup>27</sup> Rico-Villademoros, F., Hernando, T., Sanz, J. L., López-Alonso, A., Salamanca, O., Camps, C., & Rosell, R. 2004. The role of the clinical research coordinator–data manager–in oncology clinical trials. *BMC Medical Research Methodology*, 4(1), 6.

<sup>28</sup> Dessler, A. J., 1969. The role of basic research in universities. *Eos, Transactions American Geophysical Union*, 50(9), 508-511.

had any such inkling or feeling in the 1920s. This is the power of basic/pure/fundamental research: hope for the future<sup>29</sup>.

Importance of basic research is strictly connected with the emergence of new technologies and knowledge that have the ability to change the direction or accelerate the economies development<sup>30</sup>. It is clear that for significant advances in knowledge we must look primarily to basic research; the social gains we may expect from basic research are obvious<sup>31</sup>.

#### VII. VARIOUS NOBEL LAUREATES' OPINION REGARDING IMPORTANCE OF BASIC RESEARCH

The importance of basic research is well-exemplified by some quotations of various Nobel Laureates, who have visited Thailand, as follows<sup>32</sup>:

- Sheldon L. Glashow, Nobel Laureate in Physics 1979 states "The curiosity-driven research for fundamental knowledge is at least as important to human health and welfare as the search for solutions to specific practical problems. Government support of undirected basic research must continue if there are to be further technological advances and economic spin offs"<sup>33</sup>.
- William N. Lipscomb, Nobel Laureate in Chemistry 1976 states "Since research is so expensive, can a developing country like Thailand afford to do basic research? Thailand cannot afford NOT to do basic research; otherwise it will never be able to compete"<sup>34</sup>.
- Aaron Ciechanover, Nobel Laureate in Chemistry 2004 states "There is no such thing as basic and applied sciences, only good science and bad science"<sup>35</sup>.
- Tsung Dao Lee, Nobel Laureate in Physics 1957 states "Without basic research today, there will be no applications of science and technology tomorrow"<sup>36</sup>.

Indeed, the importance of basic research is increasing with advances in technological innovation and knowledge-based industries<sup>37</sup>. The importance of basic research is paramount in all

scientific endeavours<sup>38</sup>. In addition, the development research team, which started product development based on articulated demand, frequently consults with the basic research team on difficult and fundamental questions<sup>39</sup>.

Basic research always plays very significant role to make researchers, and push them to forward with motivation, confidence and achievement towards advancement in knowledge and discover according to time and needs.

#### VIII. THE QUR'ĀNIC EVIDENCE ON BASIC RESEARCH IN RESOURCES AND TECHNOLOGICAL ADVANCEMENT

Researchers are increasing their knowledge by all types of research. The main motivation for basic research is to increase man's knowledge by discovering. In this meaning almost in all form of research has character, motivation and aim of basic research. There are more than 750 verses in the Holy Qur'ān related to research in natural sciences. A number of these verses are directly order, motivate and use interrogative approach to show importance of basic research<sup>40</sup>. For example, al-Qur'ān 2:29, al-Qur'ān 7:56, al-Qur'ān 10:101, al-Qur'ān 13:3, al-Qur'ān 14:34, al-Qur'ān 15:85, al-Qur'ān 19:25, al-Qur'ān 21:16, al-Qur'ān 22:46, al-Qur'ān 30:8, al-Qur'ān 80:24, al-Qur'ān 86:5-7, al-Qur'ān 88:17-26, al-Qur'ān 96:1-5.

Considering the length of this research the researcher has showed and explained only the verse 2:29 as evidence on the Qur'ānic motivation to undertake basic research. Almighty Allāh informs the humans all that is on earth are for humans' well-being. The Holy Qur'ān reads, "*He it is who has created for you all that is on earth*" (Al-Qur'ān 2: 29).

Ibn 'Abbas interpreted that the saying of Almighty Allāh "*He it is who has created for you*" means all creatures and resources have been subjugated for humans by the Creator. The saying of Allāh '*ma fil ard*' (all that is on earth) means animals, plants and other resources. In addition, the Qur'ānic word '*jamia*'

<sup>29</sup> Moïshe Pripstein and George Trilling, 2013. The Power of Basic Science, symmetry dimensions of particle physics (an online magazine about particle physics). <https://www.symmetrymagazine.org/article/february-2013/the-power-of-basic-science> . Retrieved 19 February, 2019.

<sup>30</sup> Pohulak-Żołędowska, E. 2013. Industrial meaning of university basic research in modern economies. Managerial Economics.

<sup>31</sup> Nelson, R. R., 1959. The simple economics of basic scientific research. Journal of political economy, 67(3), 297-306.

<sup>32</sup> Boonsaeng, V., & Sobhon, P., 2007. Funding policy and strategies for basic research by academic division of the Thailand Research Fund. ScienceAsia, 33, 9-15.

<sup>33</sup> Boonsaeng, V., & Sobhon, P., 2007. Funding policy and strategies for basic research by academic division of the Thailand Research Fund. ScienceAsia, 33, 9-15.

<sup>34</sup> Boonsaeng, V., & Sobhon, P., 2007. Funding policy and strategies for basic research by academic division of the Thailand Research Fund. ScienceAsia, 33, 9-15.

<sup>35</sup> Boonsaeng, V., & Sobhon, P., 2007. Funding policy and strategies for basic research by academic division of the Thailand Research Fund. ScienceAsia, 33, 9-15.

<sup>36</sup> Boonsaeng, V., & Sobhon, P., 2007. Funding policy and strategies for basic research by academic division of the Thailand Research Fund. ScienceAsia, 33, 9-15.

<sup>37</sup> Kim, S. Y., Heo, C. H., & Min, T. S., 2007. An Analysis on Research Funding of Geosciences in Korea. Journal of Korean Society of the Economic and Environmental Geology, 40(6), 815-825.

<sup>38</sup> McDonald, R., 1991. Quantitative effects of skeletonizing processes on bone density.

<sup>39</sup> Takahashi, T., & Namiki, F. 2003. Three attempts at "de-Wintelization": Japan's TRON project, the US government's suits against Wintel, and the entry of Java and Linux. Research Policy, 32(9), 1589-1606.

<sup>40</sup> Islam, MD. Sirajul, 2020. Foundations of Research Methodology in the Holy Qur'an, PhD thesis, International Islamic University Malaysia (IIUM).

(all) means all types of favour from the Creator<sup>41</sup>. Muḥammad Sayyid Ṭanṭawī (1928 – 2010) interprets that the Creator creates all things in earth such as animals, plants, minerals, and mountains for humans. Almighty Allāh is benefactor upon humans as though they can be benefited by these favours in the world, and ordering for the help by these favours to His obedience. Moreover, scientists have received from this verse, as they are witness that all things in earth are utility, and they are authorized to utilize until the proof of their prohibited<sup>42</sup>.

Admittedly, scientists have proved in the light of basic research that each creature is playing a vital role in natural ecosystem. Almighty Allāh creates everything in this universe accurately and wisely, very beautiful in the whole appearance of creation, according to in their time, in place, in job, as required by the will and wisdom<sup>43,44</sup>. This Verse includes all creations, and informs the humankind that all creation is useful for humans, but it depends on the proper use<sup>45</sup>.

This verse is basis for basic and scientific research. It talks about all resources on the earth both resource on land and below water. How all resources for human is a research question. Hence, need basic research on natural resources to arrange acceptable answer to the question and to realize the divine information in the verse (2:29). In line with the information of the verse 2:29 all types of resources are research subjects and blessings. Hence, people have to proper use resources. Therefore, humans have to gain knowledge about these resources for proper using. Basic research is the best scientific method to gain pure knowledge, to reveal scientific facts, to identify new relationships among facts and describe phenomena. Novel information of resources can be

attained by undertaking basic research, and based on novel information could be attained timely technological development in order to cope the contemporary challenges. This verse encourages in gaining knowledge about all that is on earth and properly utilizing these blessings.

Hence, essential undertaking high quality advanced basic research to extend our understanding the earth contains what type of resources both visible and invisible; how way these resources are for humans' wellbeing; and to recognize how many ways resources have been misusing, and to discover the divine creativities in creating numerous and amazed characteristic resources. We have to find out the method of best utilizing of these resources and sustainable development by research. Thus, this verse encourages in conducting basic research as though resources might be best utilized by following environmental ethics, best resources management policy, biodiversity's' rights, ecosystem conservation, social justice, as well as human rights regardless.

#### IX. EXPENDITURE ON BASIC RESEARCH

America about \$435 million in 1953, was spent on "basic research." since 1953 expenditure on research and development has increased distinctly; \$10 billion in 1957. In addition, expenditure has increased at a rapid rate on basic research, about at a faster rate than all form of research and development expenditure. But basic research expenditure in 1957 was probably under \$1billion, less than one-quarter of 1 per cent of gross national product<sup>46</sup>.

**TABLE 1. U.S. R&D expenditures, by type of work: 1970–2016**

Type of work	1970	1980	1990	2000	2010	2011	2012	2013	2014	2015 <sup>a</sup>	2016 <sup>b</sup>
\$billions											
All R&D	26.3	63.2	152.0	267.9	406.6	426.2	433.6	454.0	475.4	495.1	510.0
Basic research	3.6	8.7	23.0	42.0	75.9	73.0	73.3	78.5	82.1	83.5	86.3
Applied research	5.8	13.7	34.9	56.5	79.3	82.1	87.1	88.3	91.9	97.2	100.3
Experimental development	16.9	40.7	94.1	169.4	251.4	271.0	273.3	287.1	301.5	314.5	323.4
Percent distribution											
All R&D	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

<sup>41</sup> Ibn ‘Abbās, 2007. *Tanwīr al-Muq̄bās min tafsīr ibn ‘Abbās*, Translated By Mokrane Guezzou, Edited and with a brief Introduction by Yousef Meri.

<sup>42</sup> Tantawy, Muhammad Sayyad. 1997. *Tfsir al-Wasit*. Publisher: Dar Nahdatu Misr lit Tabaa’ wan Nashir wa lit Tawzi’, Cairo-Egypt, 1st edition. Vol. 1, P. 5.

<sup>43</sup> Tantawy, Muhammad Sayyad. 1997. *Tfsir al-Wasit*. Publisher: Dar Nahdatu Misr lit Tabaa’ wan Nashir wa lit Tawzi’, Cairo-Egypt, 1st edition.

<sup>44</sup> Samsudin, S. B., & Islam, M. S. 2014. Environmental Ethics from the Qur'nic philosophy. *Advances in Environmental Biology*, 1160-1169.

<sup>45</sup> Islam, MD. Sirajul, et al. 2015. Herbal Medicinal Importance of *Citrullus Lanatus* Mentioned in the Ahadith: A Precise Overview. *American Journal of Ethnomedicine*, 2(1), 39-45.

<sup>46</sup> Nelson, R. R., 1959. The simple economics of basic scientific research. *Journal of political economy*, 67(3), 297-306.

Basic research	13.7	13.8	15.2	15.7	18.7	17.1	16.9	17.3	17.3	16.9	16.9
Applied research	21.9	1.7	23.0	21.1	19.5	19.3	20.1	19.5	19.3	19.6	19.7
Experimental development	64.4	64.5	61.9	63.2	61.8	63.6	63.0	63.3	63.4	63.5	63.4

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

#### X. WORKSPACE OF BASIC RESEARCH

University is a significant workspace for basic research<sup>47</sup>. Some 85 percent of the basic research funds allocated to universities have been placed by mission oriented agencies in support of their own missions<sup>48</sup>. Basic research chemists often work in laboratories, which they may share with other researchers. They may also use instruments in other local laboratories, or they may travel to national laboratories or international research centres to use specialized instruments and facilities. Some basic

researchers work outdoors, collecting samples or recording observations. Others may work mostly or entirely on computers, constructing theoretical models or building and maintaining databases. Senior researchers often work side by side with students, postdocs, or visiting scientists. They may be responsible for training and supervising others in their laboratory and for ensuring that everyone follows safety rules and research ethics protocols. Access to a good library is important, either in a physical space or online. Literature searches are an important part of planning and conducting research, and it is essential to stay current on published research in a given field<sup>49</sup>.



Basic research image in laboratory

<sup>47</sup> Dessler, A. J., 1969. The role of basic research in universities. *Eos, Transactions American Geophysical Union*, 50(9), 508-511.

<sup>48</sup> Dubridge, L. A., 1967. University basic research. *Engineering and Science*, 31(3), 9-12.

<sup>49</sup> Richard Gross, Kimberly Jackson, Ranjit Koodali, 2019. Basic Research, American Chemical Society, <https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/basic-research.html>. Retrieved 19 February, 2019.



Basic research image in library

## XI. CONCLUSION

Basic research is to increase our knowledge related to any branch of knowledge, natural and social ecosystems, natural and social phenomenon as well as natural and human resources to know what is what and why. In addition, recognizing problem and causes of problem is basic research. Scientists recognize upcoming problems related to biodiversity, environment, health as well as social ecosystem by basic research. Examining theory, testing hypothesis, formulating scientific theory, discover unique information in law of nature is prominent character of basic research. Hence, demand of basic research is evergreen forever until survive human in the earth. For example, actually establishment of human habitation in Mars is feasible or not we look forward to hear from basic research scientists. Hence, education ministry of a country and NGOs might generate Supplementary Grants for basic research to formulate Sustainable Scientific Development Theory (SSDT), and its scientific application in order to achieve the national goals that reinforce long-term ecological balance in both natural and social environment.

## ACKNOWLEDGEMENT

I am grateful to Almighty Allah who creates resources for humans' well-being, gives knowledge, time and all essential helps to do this research. I am grateful to assistant Professor Dr. Sofiah Samsudin for her motivation and academic consultation on this article.

## REFERENCES

- [1] Bhome, S. M., Prajapati, N., Deshmukh-Ghate, D., & Ghosh, A., 2015. *Research Methodology (Tools and Analysis)*, Himalaya Publishing House.
- [2] Boonsaeng, V., & Sobhon, P., 2007. Funding policy and strategies for basic research by academic division of the Thailand Research Fund. *ScienceAsia*, 33, 9-15.

- [3] Chowdhury, F., & Williams, A. 2009. From research to regulated: challenges in transferring methods. *Bioanalysis*, 1(2), 285-291.
- [4] Dessler, A. J., 1969. The role of basic research in universities. *Eos, Transactions American Geophysical Union*, 50(9), 508-511.
- [5] Dubridge, L. A., 1967. University basic research. *Engineering and Science*, 31(3), 9-12.
- [6] Gulbrandsen, M., & Kyvik, S., 2010. Are the concepts basic research, applied research and experimental development still useful? An empirical investigation among Norwegian academics. *Science and public policy*, 37(5), 343-353.
- [7] Hill, K. M., Brookes, L. G., & Hunt, H. 1969. How much basic research is enough?. *Long Range Planning*, 1(3), 38-43.
- [8] Ibn 'Abbās, 2007. *Tanwīr al-Muqḃās min tafsīr ibn 'Abbās*, Translated By Mokrane Guezzou, Edited and with a brief Introduction by Yousef Meri.
- [9] Islam, MD. Sirajul, 2020. *Foundations of Research Methodology in the Holy Qur'an*, PhD thesis, International Islamic University Malaysia (IIUM).
- [10] Islam, MD. Sirajul, et al. 2015. Herbal Medicinal Importance of Citrullus Lanatus Mentioned in the Ahadith: A Precise Overview. *American Journal of Ethnomedicine*, 2(1), 39-45.
- [11] Kim, S. Y., Heo, C. H., & Min, T. S., 2007. An Analysis on Research Funding of Geosciences in Korea. *Journal of Korean Society of the Economic and Environmental Geology*, 40(6), 815-825.
- [12] Lundvall, B.-A. and S. BORRÁS, 2005. "Science, technology and innovation policy". In: *The Oxford handbook of innovation*. Oxford University Press.
- [13] Mansfield, E. 1980. Basic research and productivity increase in manufacturing. *The American Economic Review*, 70(5), 863-873.
- [14] Mark Boroush , 2017. U.S. R&D Increased by \$20 Billion in 2015, to \$495 Billion; Estimates for 2016 Indicate a Rise to \$510 Billion, Infobrief , National Science Foundation, National Center for Engineering and Statistic s (NCSES). <https://www.nsf.gov/statistics/2018/nsf18306/nsf18306.pdf>. Retrieved 2 February, 2019.
- [15] McDonald, R., 1991. Quantitative effects of skeletonizing processes on bone density.
- [16] Moïshe Pripstein and George Trilling, 2013. The Power of Basic Science, symmetry dimensions of particle physics (an online magazine about particle physics). <https://www.symmetrymagazine.org/article/february-2013/the-power-of-basic-science> . Retrieved 19 February, 2019.
- [17] Nelson, R. R., 1959. The simple economics of basic scientific research. *Journal of political economy*, 67(3), 297-306.
- [18] Neumann, M., 2014. External Effects of Basic Research Infrastructure (No. PUBDB-2015-04244). European XFEL.
- [19] Pielke JR, R., 2010. "In Retrospect: Science - The Endless Frontier". In: *Nature* 466.7309.

- [20] Pohulak-Żołędowska, E. 2013. Industrial meaning of university basic research in modern economies. *Managerial Economics*.
- [21] Richard Gross, Kimberly Jackson, Ranjit Koodali, 2019. Basic Research, American Chemical Society, <https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/basic-research.html>. Retrieved 19 February, 2019.
- [22] Rico-Villademoros, F., Hernando, T., Sanz, J. L., López-Alonso, A., Salamanca, O., Camps, C., & Rosell, R. 2004. The role of the clinical research coordinator–data manager–in oncology clinical trials. *BMC Medical Research Methodology*, 4(1), 6.
- [23] Rosenberg, N., 2010. Why do firms do basic research (with their own money)? In *Studies On Science And The Innovation Process: Selected Works of Nathan Rosenberg* (pp. 225-234).
- [24] Samsudin, S. B., & Islam, M. S. 2014. Environmental Ethics from the Qur'nic philosophy. *Advances in Environmental Biology*, 1160-1169.
- [25] Saslow, C. A., 1982. *Basic research methods*. Addison-Wesley Publishing Company.
- [26] Singh, R., 2017. *Research and Its Types*.
- [27] Singh, Y. K., 2006. *Fundamental of research methodology and statistics*. New Age International.
- [28] Stokes, D. E., 1997. *Pasteur's Quadrant: basic science and technological innovation*. Brookings Institution Press.
- [29] Takahashi, T., & Namiki, F. 2003. Three attempts at “de-Wintelization”: Japan's TRON project, the US government's suits against Wintel, and the entry of Java and Linux. *Research Policy*, 32(9), 1589-1606.
- [30] Tantawy, Muhammad Sayyad. 1997. *Tfsir al-Wasit*. Publisher: Dar Nahdatu Misr lit Tabaa' wan Nashir wa lit Tawzi', Cairo-Egypt, 1st edition.
- [31] Vafadar, A., & Ghadimvand, N. K., 2016. *Advanced research approach*.
- [32] Zhang, K. P., & Ma, L. 2017. Prof. Yun Fan: persistence guarantees expertise, patience conquers difficulties. *Journal of thoracic disease*, 9(Suppl 11), S1162.

#### AUTHORS

**First Author** – Md. Sirajul Islam, PhD candidate, Department of Qur'an & Sunnah Studies, Kulliyah of Islamic Revealed Knowledge and Human Sciences, International Islamic University Malaysia, 53100 Jalan Gombak, Kuala Lumpur, Malaysia., E-mail: sirajulislam1981@yahoo.com

**Second Author** – Dr. Sofiah Samsudin, Assistant Professor, Department of Qur'an & Sunnah Studies, Kulliyah of Islamic Revealed Knowledge and Human Sciences, International Islamic University Malaysia, 53100 Jalan Gombak, Selangor, Kuala Lumpur, Malaysia. E-mail: Sofiahs@iium.edu.my

**Correspondence Author** – Md. Sirajul Islam  
E-mail: sirajulislam1981@yahoo.com