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AWARDS IN THE FIELD OF INFORMATION TECHNOLOGIES: SOCIAL AND CULTURAL IMPACT

Vladimir Faerman (a)*
*Corresponding author

(a) Tomsk State University of Control Systems and Radioelectronics, 40, prospect Lenina, 634050, Tomsk, Russia, fva@fb.tusur.ru

Abstract

The paper studies prestigious awards in the field of computer science and information and communication technologies (ICT) and their social and cultural impact. The flagship awards of the major international technical societies Association of Computing Machinery (ACM) and Institute of Electrical and Electronics Engineers (IEEE) are considered as objects of study. The following awards are chosen after a thorough historical review: IEEE Medal of Honor, IEEE Edison Medal, ACM Turing Award. General social and psychological functions of the awards were used as the basis for the evaluation of the impact and value of a particular trophy. Such key factors determining the value were proposed: the average annual number of awards, transparency and clarity of decision-making procedure, as well as the reputation of the awarding institutions. Implementing those criteria together with some additional factors the awards in the particular ICT awards were qualitatively evaluated. For the reference with the same criteria was evaluated Nobel Prize in Physics as the most prestigious scientific award. The comparison has revealed that the leading position of the Nobel Prize in Physics is determined not just by historical and media factors, but also by well-established multistage decision-making procedure. In concluding part of the paper, the impact of the ICT scientific awards on Russian academic and professional communities is discussed. The author believes that the awards are an important tool for promoting modern technology-oriented and global worldview among the people. And it also makes the discussion on ICT awards the essential part of any ICT course.

Keywords: Awards in science, IEEE Medal of Honor, IEEE Edison Medal, ACM Turing Awards, Nobel prize.

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1. Introduction

In modern society an important aspect of professional or commercial activity is its openness to external evaluation. In open economic systems any goods and services, being products of each particular type of activity, are evaluated by consumers or competitors. The need to stand out among other market participants and increase their recognition is one of the important incentives for companies to increase the efficiency of their activities - to improve technologies, optimize business processes and conduct advertising campaigns. (Brown & Dacin, 1997) One of the traditional ways to achieve the goal of increasing company recognition is to participate in exhibitions and competitions in order to receive awards and acceptance (Ripley, 2017). In particular, Ripley (2017) notes the following positive outcomes of this approach:

- an objective determination of their position among competitors,
- leader status consolidation of the company, improvement of product positions in the market,
- increasing of recruiting efficiency and of employee satisfaction from work.

Personal awards, complementing professional or civic achievements of individuals, in general are relevant to those which are mentioned above, although, they do not have identical meaning. Personal rewards are material or non-material rewards that are given to the recipient as a symbol of recognition of his or her achievements, or formally signal recognition from the recipient (Sugden, 2018). Such incentives are widely used and are applied in almost all areas of activities (Phillips Sir, 2004; Frey & Gallus, 2018): in sport, in the public or military service, in art, science and also in commercial activities. "Awards are widespread phenomenon. They cater for fundamental desire for social recognition and serve as valuable incentive to influence behavior" in accordance with Frey and Gallus (2017, p. 1).

Over the last decade, a widespread study of the awards phenomenon, as well as their economic (Frey & Gallus, 2015, 2016), technological (Moser & Nicholas, 2013), social (Haut et al., 2016) and psychological (Rablen & Oswald, 2008) significance. Currently, the noted trend concerning sociological and economic studies of awards continues, despite the presence of sharp criticism in assessing their influence, especially in economic one (Sugden, 2018).

The increase in the value of individual awards in modern society is happening due to the technological development and the digitizing process. Thus, according to Frey (2018), the abundance of social connections and information exchange channels, as well as the improvement of its processing tools, made it possible to quantify human activity in its various manifestations. Due to the desire of society to use accessible and publicly available information the intensification of the quantitative activity assessment contributed to the emergence of various social, media, scientific and other metrics and ratings. Nevertheless, the evidence that it is the result of unbiased population growth cannot but depend on a qualitative assessment of the activity. However, in response to this the value of public recognition has increased. It was not based on formal metrics and ratings, and this was the reason for the unprecedented increase in the number of awards based solely on a qualitative assessment of performance (Frey, 2018).

An increase in the awards diversity in any activity area devalues their symbolic value as a mark of distinction and thereby negatively affects their importance as confirming the quality of the recipient's activity, or recognizing his behavior as a reference role model (Frey & Gallus, 2018). Scientific awards

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are no exception in this regard. However, despite the growth of both the variety of scientific awards and the number of awards, from the point of view of the scientific community recognition the most significant of them have probably not changed over the past decades. Thus, the most famous (Stockton, 2014) prestigious and controversial award in modern science is the Nobel Prize (Frey & Gallus, 2015), established in 1901.

Despite the unprecedented scientific community recognition, worldwide fame and undeniable authority, the Nobel Prize is a «controversial» award. Its controversy is mainly related to the fact that the award is biased because it gives preference to one members of research teams over another for no apparent reason (Yong, 2017; Oransky & Marcus, 2016), as well as the fact that material rewards and wide public attention does not correspond to the values and principles traditionally accepted by the scientific community (Ball, 2014). Despite widespread and partially justified criticism, the Nobel Prize remains a conventionally recognized benchmark choosing the most outstanding achievements in the natural sciences, as well as in literature, medicine and economics.

Nevertheless, the Nobel Prize areas of interest do not fully reflect current trends in the science and technology development. Thus, in Understanding Science (2020), it is said that "Science is deeply interwoven with society, and as it has changed, so too has science" (para. 2). With the development of society and the technology improvement the circle of scientific problems is constantly expanding and new areas of knowledge arise. According to the analytical report (Research Fronts, 2018), the scientific field "Mathematics, computer science and engineering" is today one of the four largest areas of knowledge research.

It should be noted that in the formulation mentioned above computer science and engineering is an extensive field of knowledge that includes various industries which can also be called computations, information theory, digital electronics, networking and communications, etc. In the framework of this study these branches of knowledge are united by the concept of Information and Communication Technologies (ICT). This research area is reflected in the areas of interest of the Association of Computing Machinery (ACM), as well as, to a slightly lesser extent, in the areas of interest of the Institute of Electrical and Electronics Engineers (IEEE). You can find particular topics in the names of ACM SIGs (2020) as well as in the names of plenty IEEE Societies (2020). The flagship scientific awards of these societies are of high value, comparable to the Nobel Prize, and are influential from a social and cultural points of view.

Studying the history and value of the key scientific awards in the field of ICT has a research interest and will allow identifying the most significant achievements from the point of view of the history of computer technology. Also, it will identify key areas of information technology development. The practical significance of the study is in the fact that studying the history of awards allows you, firstly, to identify the best practices in the creative activities of recipients in order to determine professional computer and telecommunication scientists` standards on their basis. Secondly, their success stories can be used to popularize science and enhance the prestige of a scientist's career among ICT students and society as a whole. The latter is especially relevant in the context of the observed demographic shift in the scientific community described in (Miloejevic et al., 2018), which consists in the increase in the number of researchers who has abandoned their academic careers in favor of more practical activities. Despite the

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fact that the scientific career abandonment is usually considered as a negative event, it can also indicate the interpenetration of the academic and professional communities, especially in the field of information technology and telecommunications.

2. Problem Statement

The scientific knowledge development and the change in its structure connectd with the fourth information revolution has led to the emergence of new science and technology areas (Dubois & Gershon, 1996). The latter has had a qualitative and quantitative impact on the academic community and its research. For example, more than 10% of scientific papers published in 2018 were devoted to information technology and computer technology according to the Clarivate Analytcs report (Research Fronts, 2018).

However, despite the long history of the computer science and computer technology development, which has been at least 80 years by now, there are no scientific awards in this area comparable to the Nobel Prize in terms of public recognition, as well as in its cultural and social significance. It should be noted that the latter fact, from the author's point of view, is a consequence of the wide publicity of the brand, the emergence and promotion of which happened due to historical factors (Stockton, 2014), many of which have lost their relevance today.

This article is devoted to the study and discussion of the thesis that the flagship scientific awards in the field of computer science and computer technology, established by the leading professional communities ACM and IEEE, are not inferior to the Nobel Prize in a number of aspects which determine their value. At the same time, their lack of public fame limits their positive social and cultural influence.

3. Research Questions

A systematic study of the cultural and social significance of scientific awards in the field of computer science and computer technology involves answers to the following set of questions:

- What are the functions of awards in modern society?
- What specific features are typical for awards for scientific achievements awards?
- What factors and circumstances determine the value of scientific awards?
- How do the values of the IEEE and ACM flagship awards correspond to the Nobel Prize?
- What determines the cultural and social significance of ICT awards?
- What is the reason for the difference in public perception and the influence of the Nobel Prize and awards in the field of ICT?

4. Purpose of the Study

Recently, the study of awards and other forms of intangible incentives for motivation (Frey & Gallus, 2015) and people's performance (Kovacs & Sharkey, 2014) has become very relevant. Awards are seen as incentives (Haut et al., 2016) and as control signals (Frey & Gallus, 2016). Attempts have been made to assess the social and cultural impact of awards in various fields of activity (Ginsburgh, 2003; Moser, 2013).

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The objective of this work is to apply the theoretical results achieved by other researchers and formulated theoretical principles to determine the place of scientific awards in the field of ICT (for example, the main IEEE and ACM awards) in the global system of awards and decorations. The widely known Nobel Prize is used as a guideline in this system. The practical component of the study is aimed at assessing the social and cultural impact of the studied awards and substantiating the advisability of teaching this information to IT students.

5. Research Methods

The combination of listed further methods are used in the reported study.

- Qualitative methods are used to specify the distinguishing features of scientific awards in comparison with awards in general. Also the qualitative methods are used to determine the qualities that make specific award valuable both for recipient and for professional community he belongs.
- Historical method is used to reveal the origins and the traditions of flagship ACM and IEEE awards. For this purpose, historical reviews, lists of recipients, original messages about the awards, nomination and celebration policies of the time are examined. Award-winning achievements and inventions are retrospectively analyzed to prove their impact on modern society.
- Some media analysis is used to estimate the social impact of the awards under study.
- The conceptual relation between technology, science and culture is used to describe cultural impact of scientific awards.

6. Findings

Before discussing the social and cultural influence of leading scientific awards in the field of ICT it is necessary to answer a number of general questions related to awards as a social phenomenon. This is essential in order to rely on the functions of the awards as a whole to determine the qualitative criteria affecting the value of scientific awards for the recipient and his or her professional environment. The next flagship awards of the largest professional communities are analyzed for compliance with the formulated criterion: ACM Turing Awards, IEEE Medal of Honor, IEEE Edison Medal. The Nobel Prize in Physics is evaluated in a similar coordinate system for comparison. Then an assessment of the cultural and social influence of the scientific research awards is made, and the importance of this information distribution among students studying at IT universities is substantiated.

6.1. Scientific awards as a social phenomenon

In modern society, awards carry a variety of functions and, therefore, have value for both the recipient and the giver. Scientific awards are no exception. The following are the results of a qualitative study of the awards functions and the factors that determine their value.

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6.1.1. What are the functions of awards?

According to Phillips Sir (2004) “the honours system derives from the simple and laudable wish to recognize exceptional service and to show gratitude publicly” (p. 15). Indeed, the literally universal award systems distribution at the state level indicates the need to celebrate outstanding achievements. At the same time, the high acceptance rate from the award recipients also shows their high evaluation of awards. This can be explained by the fact that the fundamental social need of a person is recognition by the group which membership he or she belong to (Frey, 2006).

A more detailed analysis of the mechanisms of the awards impact on the recipient and the social environment is given in (Frey & Gallus, 2015, 2017). Thus, the effect introduced by the awards and forming their value for the recipient is as follows.

1. *Personal psychological effect*. For the recipient, the award is a signal of recognition and approval. This increases his or her self-esteem and strengthens his or her sense of satisfaction with his own activities.
2. *Pers*onal *material advantage*. It can be either direct or indirect. In the first case, the material benefit directly (in the form of prize money, regular payments or non-financial bonuses) follows from the fact of receiving the award. In the second case, the material benefit is the result of improving the recipient's business reputation, public consolidation of his or her competencies or establishment of useful social contacts.
3. *Personal social status gain.* The recipient receives a special social status that separates him or her from other people. The public celebration of the recipient is mandatory and has an important symbolic meaning. The latter is caused by the necessity to make a distinction clear to the reference group or to a wider audience.
4. *Bond between giver and recipient.* The provision of the award creates a special relationship between the recipient and the giver and at the same time openly declares their mutual loyalty. Accepting the award the recipient confirms his or her commitment to the values (institutional or corporate) declared by the giver.

At the same time, the awards are a tool used by a giver. The functionality of this tool is determined by the following effects (Frey & Gallus, 2017)

1. *Encourage loyalty of the recipient.* The award gives the recipient a sense of the importance of their own activities and appreciation for the high estimation. These circumstances increase the likelihood of continued work for the benefit of the giver.
2. *Establishment of role model.* Rewards contribute to the formation of role models that reinforce constructive behavior that is useful to the community or society as a whole.
3. *Motivational effect.* Non-recipients within the reference group gain an additional stimulus to act in a desired way. Along with the previous paragraph, this effect is important in the business sphere.
4. *Promotion of merits and ethical values.* The establishment, maintenance and presentation of the award reinforce the declared values and encouraged benefactors as part of the giver`s image. This contributes to both strengthening the rewarding brand and promoting ethical values among employees or followers.

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6.1.2. What distinguishes scientific awards?

Awards can be divided into two types (Frey & Gallus, 2015). Confirmatory awards are awarded as a result of the recipient`s achievement of the previously announced award criteria. Criteria are measurable or registered, and the fact of achievement does not need interpretation. In contrast to this, discretionary awards do not imply clear award criteria. The award`s recipient is determined with the participation of other people and is based on their subjective assessments.

Scientific achievements in any field are always a unique result of creative activity. There can be no unambiguous and formalized criteria for comparing different results even in related areas. In this regard, almost all scientific awards belong to the second type. The exceptions are the innovation prizes (Frey & Gallus, 2017; Moser, 2013), which are monetary prizes for solving problems from the public list.

Scientific awards also have a number of other features that distinguish them from awards in sports, science or business. Brown (2015), the Nobel Prize winner in 1985, presented the main theses on the features of scientific awards in his interview.

The features of scientific awards are presented in the form of theses on what features science does not share.

1. *Science is not sport*. Sport involves competitiveness and demonstrating excellence, and results improving is its main goal (Haut et al., 2016). Achievement these goals is rewarded. Unlike sports, competition is not supposed to be an integral part of academic activity, although, it is present in it. The fundamental goal of scientific activity is to gain new knowledge, and not to achieve superiority over colleagues.
2. *Science is neither volunteering nor military.* The awards for military or volunteer service mark not achievements but rather noble intentions and personal morals and values of the recipient such as dedication, courage and commitment to humanitarian principles. Scientific awards are based on the objective achievements of the recipient and not on his intentions and personal qualities. The latter means that the best scientists are not necessarily moral authorities and criticism of awards from these positions is inappropriate (for example, in Oransky & Marcus, 2016).
3. *Science is not art*. An achievement in art is the creation of an object of high aesthetic quality. Although there is no unambiguous and conventionally recognized definition for aesthetic quality (Gracyk, 1999), it is suggested that the aesthetic value of an art object should not decrease over the years (Ginsburgh, 2003). Thus, those people whose creations will pass the test of time are awarded. Although this is the present intention, in practice the predictive power of awards' committees is not so great (Ginsburgh & van Ours, 2002: Ginsburgh, 2003). Unlike art awards, scientific awards are awarded for achievements that have already shown their outstanding importance.
4. *Science is not rock-n-roll.* Scientists rarely go to heaven at 27. As a rule, longevity is the key to recognition in science. Recipients of scientific awards, with rare exceptions, are of a senior age. The obvious exception is awards given exclusively to scientists under the age of 40 (Chan et al, 2014).

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6.1.3. What makes scientific awards valuable?

Currently, there is a huge number of scientific awards and not all of them are equally prestigious. The value of the award is determined, on the one hand, by its complex effect on the well-being of the recipient, and on the other hand, by the strength of the signal sent to reference group and b eyond. Despite the variety of mechanisms that influence rewards, their effect is largely determined by the same comprehensive set of factors studied in the literature (Frey & Gallus, 2016, 2018).

- *Rare awards are more valuable.* The principal circumstance of the award is that those awarded remain a minority. The more rewards take place, the more the value of each reward is devalued for both the recipient and the giver of the award.
- *Giver`s status affects the value of the award*. The award symbolizes recognition from the giver of the award. The higher the status of the recipient is, that is the wider social group he represents, the more significant the award in public consciousness is.
- *Giver`s reputation affects the value of the award.* The organization providing the award connects its reputation with the previous award and the subsequent activities of the awarded person. Maintaining a reputation for a long time requires, on the one hand, careful selection of those who are awarded in accordance with the declared criteria and extolled values. On the other hand, it sets high standards for the internal activities of the award-winning institution. The latter is especially possible when it is supposed to publish internal documents: nominations, recommendations and protocols.
- *The award history shows value.* Awarding creates a connection between the recipient and those who have received the similar award earlier. The higher the social status and the more significant the achievements of those who have been awarded earlier, the more valuable the award is. At the same time, public refusals to award on one or another basis compromise her status.
- *Transparency of evaluation criteria and award procedures is a guarantee of status.* The more understandable the criteria for providing the award and the better the procedure for selecting the winner is organized, the greater value the award has. The involvement of a large number of community representatives in the nomination and discussion of candidates positively affects the status of the award.
- *Honorarium and celebration affect value as well.* Despite the fact that the symbolic value of prestigious awards outweighs the material component for their owners, the cash prize still has its value. In addition, the public procedure for honoring the winner is important symbolicly for the formation of the award status. Prestigious awards have a long honoring tradition.

6.2. Awards for achievements in ICT field

As mentioned above, a variety of awards is an integral attribute of the modern world (Frey, 2018). Diversity is also a characteristic in the field of scientific awards: in many countries there are state awards for scientists, awards of national academies of sciences, awards of national and international professional and academic communities, as well as honorary titles of universities. Apparently, the nomenclature of awards for innovators, scientists and enlighteners comprises several thousand positions. In the course of

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the further research attention is paid to the flagship awards of the largest technical and academic organizations, which sphere of interests mainly is in the field of ICT.

The largest technical association in the world is the Institute of Electrical and Electronics Engineers which includes 422 thousand members in 160 countries (IEEE, 2020). The award program adopted by the IEEE is amazing in scope and includes 15 IEEE Medals and Recognitions, 31 Technical Field Awards and more than ten dozens various awards provided by 39 technical societies and standard association within the Institute. Flagship awards with a rich history and high prestige are the IEEE Medal of Honor (Bart & Bart, 2018a) and the IEEE Edison Medal (Bart & Bart, 2018b).

Another major technical association that is fully focused on ICT development is the Association of Computing Machinery which has over 100,000 members in 190 countries (ACM, 2020). The ACM award program is also well developed and includes 20 ACM-level award and almost one hundred SIG-level awards. The ACM Turing Award is recognized as the most prestigious award in the field of information technology among the ACM awards (Zou et al., 2009).

6.2.1. IEEE Medal of Honor

As Bart and Bart stated (2018a, p. 1255), "the Medal of Honor is the IEEE's most prestigious award for meritorious accomplishments in the fields of electrical and electronical engineering. Since 1917, the most important contributors to these fields have received the Medal in recognition of their critical roles in laying the foundation of modern electronical world."

IEEE Medal of Honor was instituted after merging of American Institute of Electrical Engineers (AIEE) and Institute of Radio Engineers (IRE) in 1963. Before this date the medal was awarded as IRE Medal of Honor. It should be noted that the interests of IRE and AIEE were not overlapped to any extent, and the communities themselves were relatively few in number. In IEEE (IEEE Awards, 2020) there is no separation between the holders of the IRE Medal of Honor and the IEEE Medal of Honor, despite the significant differences in procedures and policies.

The original medal was established on February 15 in 1917 "to recognize the prominent advances made in radiotelegraphy and radiotelephony" (Bart & Bart, 2018a, p. 1255). Creating the medal the founders declared some basic principles for its award which are still valid today. For example, in accordance with them achievements that aspire to a medal must be public and fully described in publicly available sources. In addition, any technical achievement should be embodied as a device in the conditions of current technical level. Initially, it was assumed that only the accomplishments made in the two years preceding the award should be celebrated with it. However, this restriction was removed two years after the establishment and actually never acted (Bart & Bart, 2018a).

The first award was postponed due to the participation of the United States in the Great War and took place only in April 1919. Edwin Armstrong, who developed the principles of frequency modulation of the radio signal, was the first winner of the award. The third medal holder in 1920 was the well-known radio physicist Guglielmo Marconi, and the award ceremony was attended by more than 1000 leading radio engineers and radiophysicists of the world (Bart & Bart, 2018a). This event had an impact on the quick consolidation of the new award reputation, as well as on the credibility of IRE as a global leading professional organization.

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Despite the conflicts, there has never been a single refusal to award (Bart & Bart, 2018a). An attempt to return the medal was made by Reginald Fessenden, having discovered that his medal is made of base alloy and believing that the Marconi`s medal is made of pure gold. However, after the research proving that the medals were identical, he agreed to accept the award. Another attempt to refuse the award was made by the first recipient Edwin Armstrong protesting that the rival Lee de Forest was given priority to the invention of the regenerative circuit. However, in 1934 the IRE Executive Committee refused to accept the award back, having recognized Armstrong's primacy (Bart & Bart, 2018a).

In recent decades the IEEE Medal of Honor has been awarded to pioneer investigators and inventors in the ICT. Among the most famous contributors (IEEE Medal of Honor Recipients, 2020) the next people could be mentioned:

- James L. Flanagan – the researcher of the human speech and human hearing phenomenon whose research made it possible to construct modern devices and recording formats for recording, playing and audio signal transmitting processes;
- Gordon E. Moore – One of the founders of Intel company and a technologist whose innovations gave rise to mass production of microprocessors;
- Andrew J. Virebi – the inventor of the coding algorithm that made wireless connection from GSM and from 3G to Wi-Fi possible;
- John L. Hennesy – the pioneer of RISC processor architecture which has become standard for all modern PC;
- David G. Forney, Jr – the inventor of modern digital modems , error-correcting coding and quadrature amplitude modulation which have providedo the basis for distributed computing networks and cloud technologies.

6.2.2. IEEE Edison Medal

Along with the IEEE Medal of Honor, IEEE Edison Medal is the oldest and one of the most prestigious IEEE awards. Prior to the formation of IEEE in 1963, the medal was the highest award of the AIEE. Despite the fact that “IEEE Edison Medal is awarded for a career of meritorious achievement in electrical science, electrical engineering, or the electrical arts“ (Bart & Bart, 2018b, p. 325), it is directly related to the ICT field of study.

The idea of medal establishing arose in 1904 in connection with the upcoming 25th anniversary of the incandescent lamp invention. Former colleagues, employees and friends of Thomas Edison were the initiators of the medal origins. Firstly, the medal was intended to encourage and stimulate young inventors and engineering students and was accompanied by a small cash prize of several hundred dollars (Bart & Bart, 2018b). However, the award existed only until 1908 in this format and was not presented for various reasons.

Since 1908, the medal was established under the patronage of AIEE and was first awarded to Elihu Thomson, known as the inventor of arc welding and gas-discharge lighting. The first award took place at the annual meeting of the AIEE in 1910 and after that became an annual one. The first recipients of the medals were outstanding inventors whose creative contribution to electrical and industrial energy is difficult to evaluate. So, Elihu Thomson is the author of more than 700 inventions, George Westinghouse

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and Nikola Tesla has about 300 patents, William Stanley - 129 patents. It is noteworthy that all of the above were AC supporters in "war of currencies" and were considered by Edison as rivals. At the same time, Edison was not required to participate in the ceremony, and he often refused his right to congratulate the recipient because of personal dislike (Bart & Bart, 2018b). The first and only case of medal refusal occurred in 1926 and was initiated by William Coolidge in connection with the termination of his patent by decision of the US Circuit Court (Bart & Bart, 2018b).

Starting from 1963 IEEE Edison Medal lost the status of the highest award of the Institute is characterized as "IEEE principal medal". However, "the Edison medal is considered as the highest American award" (Bart & Bart, 2018b, p. 325) in the field of electrical science, electrical engineering and electrical arts. Moreover, the Edison medal is the oldest award for scientific contributions to electrical science.

Although the initial achievements noted with Edison Medal are far from the ICT field, these areas now overlap significantly. It is noteworthy that the sponsor of this award is Samsung Electronics Co. Among the last medal recipients there are many researchers whose contribution to the ICT field is undeniable (IEEE Edison Medal Recipients, 2020):

- Dov Frohman-Bentchowsky – the inventor and developer of EPROM memory which organisation principles gave rise to the modern flash-memory;
- Tingye Li – the theoretician of fiber-optic telecommunication networks which have become the basis of the telecommunications infrastructure for data transmission across the oceans;
- Ralph Bae – appreciated "father of videogames", the creator of the first game console and video game as well as the author of more than 70 inventions;
- Robert Brodersen – one of the ideologists of wireless communication who at the beginning of 1990s developed the first functional mobile devices featuring low power consumption, wireless connection and small size.

6.2.3. ACM Turing Award

The most prestigious ACM technical award that is often accompanied in media with the tagline "the Nobel Prize in computing" (Hanson, 2017; Vardi, 2017; Zou et al., 2009) was established in mid-1960s. Despite public activities of ACM and widespread public attention to it the initial stage of its history is not entirely clear. According to Vardi (2017), initially the organizing committee from the leaders of ACM did not intend to create it as a major award, but to start a series of honorary lectures at the annual meeting of the association. In 1965 the ACM Council named the event after the outstanding British mathematician A.M. Turing.

It should be noted that the reasons for this choice, as well as the circumstances due to which the annual lectures turned into a major award, are unknown (Vardi, 1967). The award received an increase in prestige and wide public attention in the early 2000s. This time period is characterized by an increase in the social significance of ICT and the influence of ACM as an organization. In 2004 the ACM Turing Award received financial support from Intel. In 2007 Google joined the sponsorship, and the award started to be accompanied with a cash bonus of 250 thousand USD. It was during this period when the Turing Award began to be positioned as the Nobel Prize for Computing in the media. In 2014 cash rewards were increased to $ 1 million (Wolf, 2014) at the initiative of Google.

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The first scientist who read Turing Lecture in 1966 was Alan Perlis, an ex-president of ACM and a pioneer in high-level programming languages. From that moment on, the Turing Award was awarded annually. There have never been any refusals to accept a prize from recipients. Since its inception, many prominent scientists who have contributed to the modern digital world have been awarded the Turing Award (ACM Turing Award, 2019):

- Vincent Cerf and Bob Kahn – creators of the TCP/IP protocol stack, which has become the foundation of global computer networks including the Internet;
- Charles P. Thacker – developer of Xerox Alto (the first PC 1973 with a graphical interface and various manipulators) which was ahead of its time by 20 years but never took its place in the market;
- Martin E. Hellman and Whitfield Diffie – creators of the concept and algorithms for using public keys и digital signatures which today are the basic tool that protects user data including conducting network transactions;
- Tim Berners Lee – Creator and ideologist of WWW-solutions, which laid the basis for creation of modern global Web-network;

6.2.4. Comparison of awards

Some details regarding the awards under study are aggregated n Table 1. Information is based on IEEE Policies (IEEE Policies, 2018; IEEE Awards Board, 2019) and ACM Policies (ACM Bylaws, 2020; ACM Awards, 2020). Information on Nobel Prize in Physics (Nobel Prize, 2020; Nobel Laureates, 2020) provided in Table 2 for reference.

Table 01. Multi-criterion comparison of the awards

	IEEE Medal of Honor	**IEEE Edison Medal**	**Turing Award**
1. Laureates	Individual [member or not]		Individual (or a group up to 3) [members or not]
2. Procedure	• open nomination (with 3 to 5endorsements) • Medal Committee choses a winner and an alternate • Medal Council reviews the decision by medal committee • Awards Board reviews validate that procedure was competitive and endorses a recipient • Board of Directors approves the recipient		• open nomination (with 4 to 8 endorsements) • Turing Award Subcommittee choses a winner • Awards Committee overseas a selection process and confirms a recipient
3. Committee	• Medal Committee is composed by 9 volunteers • members of Medal Committee (as well as Medal Council) are appointed by Awards Board and the decision is based on candidate's expertise • members of Medal Committee shouldn't be IEEE members, but they should represent different regions and institution • 1/3 of members rotates annually, leaving members suggest replacement candidates to Awards Board • Awards Board members hold an offices for a year terms (up to three terms in a row),		• Turing Award Subcommittee is composed by 10 member volunteers • subcommittee members appointed by Awards Committee • Awards Committee members resign when new ACM President is elected or when their term is expired • recruiting new Awards Committee members is

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	application for a vacant position is open for IEEE Members		supervised by the committees' vice-president
4. Criteria	• the achievement • impact on society • impact on profession • breadth and originality • patents/papers • quality of nomination	• technical leadership • duration of dominance • individual contribution • breadth and originality • patents/papers • accomplishments • honors • quality of nomination	• technical leadership • duration of dominance • individual contribution • breadth and originality • patents/papers • accomplishments • honors • quality of nomination
5. Prize	• gold medal • bronze replica • 50 thousand USD • Honor Wall (inscription)	• gold medal • bronze replica • 20 thousand USD	• trophy • 1 million USD
6. Celebration	Honors Ceremony on IEEE Annual Summit, announcement in IEEE Spectrum	Honors Ceremony on IEEE Annual Summit, announcement in Proceedings of IEEE	ACM Awards Banquet, Turing Award lecture, announcement in Communication of the ACM
7. Winners	100 (0,96 per year)	107 (0,96 per year)	70 (1,32 per year)
8. Associations	• 9 Nobel Prizes in Physics • 10 IEEE Edison Medals • 1 ACM Turing Award	• 1 Nobel Prizes in Physics (*) • 10 IEEE Medals of Honor	• 1 Nobel Prizes in Economics (**) • 1 IEEE Medals of Honor (***)

Notes: * Robert Millikan, the only recipient of Nobel Prize, was awarded with Edison Medal not for significant engineering contribution, but for leadership in turning civilian science to war effort du ring WWI (Bart & Bart, 2018b).

** Herbert Simon's contribution to ICT was not technical in nature. He received Nobel Prize in Economics (1978) and Turing Awards (1975) as well as Award for Distinguishing Contribution to Psychology (1969) for his pioneering studies on human cognition and decision making mechanisms (Spender, 2015).

*** Despite the weak cross-association between IEEE Medal of Honor and ACM Turing Award, scope of those awards overlaps clearly. Among 70 recipients of Turing Awards 22 are also awarded with IEEE-level major awards: John von Neumann Medal (been given since 1992), Hamming Medal (been given since 1988) and Graham Bell Medal (been given since 1976). Almost half (15 of 32) of John von Neumann Medal recipients also have a Turing Award. Full lists of awardees are accessible on the corresponding websites (ACM Turing Awards, 2019; IEEE Awards, 2020).

Table 02. Reference evaluation of Nobel Prize in Physics

	Nobel Prize in Physics
1. Laureates	Individual (or a group up to 3)
2. Procedure	• qualified confidential nomination. There are approximately 3000 nominators including representatives of national science academies, leading world universities, Nobel Laureates in Physics or Chemistry, and invited nominators • all nominations are reviewed by Nobel Committee for Physics. About 300 nominees are assessed on this stage. • Nobel Committee for Physics appoints experts among global scientific community and consults with them on preliminary candidates. • Nobel Committee for Physics submits report with recommendations to the Royal Swedish Academy of Sciences. All members of the committee should reach a consensus to submit the reports. • Physics Class of the Academy (several dozen academicians) holds two meetings to discuss the report. • the Royal Swedish Academy of Sciences (several hundred members) selects the

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	winner by the majority of votes. • Information about nominees and nominations can be revealed 50 years after .
3. Committee	• there are 8 voting members (or adjunct-members) in the Nobel Committee for Physics. All members of the committee are members of the academy. • Nobel Committee for Physics is appointed on the Royal Swedish Academy of Sciences meeting. The committee members serve for three years. • Nobel Committee for Physics has clear impact on the academy's decision, but has rather a technical than a decisive role.
4. Criteria	• significance of the achievement that is tested-by-time (20 years after discovery) • personal leadership and pioneering in the achievement's area • individual contribution to discovery • number and quality of nominations as well as status of nominators
5. Prize	• gold medal • up to 3 replicas (gold-plated bronze) • 930 thousand USD
6. Celebration	Nobel Prize Award Ceremony, Nobel lecture.
7. Winners	213 (1,79 per year)
8. Associations	• 1 Edison Medal • 9 IEEE Medals of Honor (*)

Notes: * John Bardeen from the Bell Labs received IEEE Medal of Honor (1971) and two Nobel Prizes in Physics (1956 and 1972) for his ground-breaking works on transistors and superconductivity (Bart & Bart, 2018a).

6.3. Social and cultural impact of the awards in the field of ICT

The development of modern world society is connected with the implementation of such global trends as a gradual worldwide decrease in violence, an increase in the duration and quality of life, and also an integration of national and local communities into global ones (Andreev, 2019). The maintenance and development of these trends is associated with the education level and the formation of scientific picture of the world (Furuta, 2010), and also with the acceptance of creativity and freedom as fundamental values (Volokhova, 2020).

6.3.1. Social value

The event of awarding with prestigious awards is important for the professional group which the recipient belongs to. At the same time, the value of such events goes far beyond their limits. Studies in (Haut et al., 2016) show that scientific and technological advances are more significant than sports or cultural ones in terms of national pride forming. The formation of technological or scientific achievements as one of the identification elements is also essential from the point of view of increasing the social status of science as an institution.

The recipients become role models that demonstrate success and offer best practices for replication. This is an item on the agenda for the ICT field where continuous changes, which are qualitatively changing the lives of wide society sections, have been being observed over the past few decades. During this time, activity in the digital technologies field has become a significant factor in the development of state economies and has provided employment for a large number of specialists. Attracting young specialists to current challenges and involving them in the international professional community has a beneficial effect on scientific and technological progress and the economy. The constructive creative activity stimulation in the field of ICT is one of the direct functions of the studied awards.

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It should be noted that scientific achievements, which have become the basis for the ICT development and dissemination, almost always remain unknown outside the professional community. At the same time, this area technology development attracts public attention and has great media interest.
The observed awards do not create such significant news rush as the Nobel Prize does. Mass media coverage and public discussion make the Nobel nominees and their achievements widely known. This does not happen to ICT achievements holders for the following reasons.

- Historically, the studied awards have been formed and are currently positioned as an exceptional form of recognition by the professional community, which makes their image not so attractive outside its framework. It should be mentioned that along with the Nobel Prize, Kyoto prize and Breakthrough prize, which are much inferior to the first in public fame, are also positioned as awards for contributions to humanity.
- Information and telecommunication technologies are considered mainly as an area of applied developments and achievements. Every person has the experience of using devices and technologies that have become possible due to this field scientific progress achieved over the past 50 years. Nevertheless, it is usually impossible to associate specific scientific achievements with specific user experiences. The latter is connected with a huge number of technologies, standards and elements that create the basis of publicly available technologies and, at the same time, form the user experience.
- The award procedures specific to both ACM and IEEE can be described as transparent and open. Potentially, anyone can participate in the winner nomination, and any qualified volunteer can apply for a place on the committee that makes key decisions. However, these procedures are inferior in publicity to the one used in awarding the Nobel Prize in Physics. The latter involves more than 3,000 scientific organizations that offer several dozen nominees. For IEEE awards, the number of qualified nominations is usually within the limit of ten. This difference is due to the fact that the members of the committee participating on a volunteer basis are limited in time and the possibility of considering a large number of nominations.

6.3.2. Cultural value

Science as a specific form of human activity is an integral part of culture, and in modern society the weight of it is increasing. The outlined above trends, being specific for modern society, in their development are based on the scientific picture of the world where the results of rational understanding of reality, excluding speculation and stereotypes constitute its basis. The development of culture is associated not only with obtaining new scientific results, but also with their integration into the system of world views approved in the modern society.

The degree of commitment to the scientific picture of the world is associated with the popularity and prestige of science in society. The popularity of science is determined by a set of factors such as people's awareness of scientific results and their impact on culture and life, the prestige of scientists and scientific activity, as well as the promotion of creativity and scientific rationality as values. Awards for scientific achievements are an evident tool that can solve all the mentioned tasks.

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This is especially true for awards in the ICT field. The scientific picture of the world for a modern person is not determined by natural sciences and life sciences. The share of digital technology in everyday life has made information and communication science a necessary fragment of the picture of the world as a whole.

6.3.3. Application in university ICT courses

The information on awards and awards in the ICT field contains not only the history of the subject field itself, but also the history of the professional community involved in its development. In the discussion of the achievements and awards with which they are noted, it is possible to retrospectively identify the challenges facing the researchers, as well as the evolutionary line of the scientific and technical solutions which they offer.

An awards is a social phenomenon linking scientific achievement, the personality of the researcher, the professional community and the society as a whole. A description of all these circumstances in their relationship forms the most complete picture among the students and, at the same time, can be presented in a popular form in isolation from technical details. This allows you to use similar materials both in teaching introductory courses for Computer Science students, and for presenting these materials in the format of open seminars, as part of volunteer activities of members of IEEE or ACM organizations.

7. Conclusion

The article is devoted to a systematic study of prestigious scientific awards in the ICT field and their role in modern society. The flagship awards of the largest international professional organizations ACM and IEEE were selected as the main objects of the research. These are the IEEE Medal of Honor, the IEEE Edison Medal, and the ACM Turing Award. Despite the fact that the awards program both of ACM and IEEE are developed and diverse, only these ones mentioned above has been historically formed as the most prestigious.

As part of a systematic study, a review of modern scientific works analyzing the mechanisms of awards influence and intangible rewards at a personal and group level is made. The main mechanisms of the awards influence on the personality, welfare and status of the recipient, as well as on the motivation and value picture of the reference group to which the recipient belongs, are determined based on the review.

Further research on the phenomenon of awards was continued taking into account the specifics of scientific activity and its values. The focus on knowledge, as well as objectivity as the main value, affect the scientific awards nature and determine their specificity. Scientific awards fundamentally differ from awards in sports, in art and public service. Nevertheless, to one degree or another, they use the same mechanisms and influence both the recipient and his or her environment. Taking into consideration the global nature of modern science and its colossal cultural significance, the society as a whole is exposed to its influence.

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The final part of the qualitative research is devoted to the definition and description of the factors that determine the value of a scientific award. The latter concept takes into account the usefulness for the recipient determined by the positive impact on his or her psychological, material and social well-being.

At the same time, the value of the award takes into account the intensity of the signal sent to the target group and outside. Both of these value components are interconnected and, apparently, are determined by one set of factors. Among these factors rarity, historical consistency, reputation and previous awards, openness and publicity of the competitive procedure, as well as the publicity of honoring the recipient can be named. An important though not a determining factor is a monetary constituent.

A comparative analysis of the leading awards in the ICT field and the Nobel Prize in physics was performed to determine the correlation of the concepts of "value" and "prestige" within the framework of the offered coordinate system. Despite the fact that in a number of aspects the studied awards correspond to the most prestigious scientific award, there are also some differences. The fundamental difference concerns the procedure for winner determining which at the Nobel Prize expects involving a large number of both internal (in relation to the institution issuing the award) and external participants. At the same time, internal participants are members of the Royal Academy of Sweden and perform their duties on a professional basis. At the same time, for all ACM and IEEE awards it is true that despite the openness and publicity of the competition the decision to issue an award is made by a small number of qualified volunteers. This is a consequence of consistent observance of the declared values which are the commercial component minimization of the activity and the volunteering reliance. On the negative side, this approach cannot provide a high level of involvement in the process from the global academic community outside ACM or IEEE. Despite the fact that ACM and IEEE are relatively large organizations their representation is still insufficient and uneven throughout the world. A lower level of community involvement in determining the winner affects lesser public fame and, consequently, lesser social significance. The last two factors, along with the value, determine prestige.

The final part of the article discusses the impact of the mentioned above awards on the modern society in the social and cultural aspects. The social significance of the awards consists in the realization of their direct function - stimulating constructive creative activity aimed at the development of technologies in the public interest. Moreover, important scientific and technological achievements, marked by prestigious awards, are an essential element of self-identification of national or professional communities. Cultural significance consists primarily in the promotion and the development of the scientific picture of the world by increasing the prestige of scientists and popularization of scientific achievements. In recent decades the entering of digital devices into everyday life forms an obvious request for knowledge about basic ICT principles. Based on the arguments mentioned above, the author focuses on the importance of teaching the presented information both in the form of basic university courses and in the open lectures format.

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