Mustafa Babanli was born to a family of teachers in Saatli, Azerbaijan SSR on February 21, 1968. Upon graduation from a high school of physics and mathematics profile in 1983, he entered the faculty of Engineering and Physics, Faculty of Physics of Metals at Kyiv Polytechnic Institute. Following his cum laude graduation, he started his career as an engineer-technologist at Kristal Special Design Bureau under the Azerbaijan National Academy of Sciences.

Mustafa Babanli received post-graduate education at the Institute of Physics of Metals of the National Academy of Sciences of Ukraine in 1990-1992 and earned PhD in physics and mathematics, having defended his thesis "Phase transformations in extremely rapidly cooled TiNiCu alloys" in 1993. After returning to his homeland, Azerbaijan in 1996, Mustafa Babanli got employed at the Azerbaijan Technical University, where he has been working ever since.

On November 4, 2010, Mustafa Babanli was appointed Vice-Rector for International Relations. On December 29, 2010, he was elected professor of the Metallurgy and Metal Sciences Chair. At present, he works as a scientific advisor to a doctoral thesis and 4 PhD theses.

Mustafa Babanli defended his doctoral thesis at the Dissertation Council of the Technical University on 27 February 2008 and received his degree of Doctor of Technical Sciences on January 23, 2009. At present, he is a member of the above-mentioned Dissertation Council.

On September 3, 2015, Mustafa Babanli was appointed Rector of the Azerbaijan State University of Oil and Industry. He is a member of the International Association of University Presidents, serving as Regional Chair for Middle East, Caucasus & Central Asia.