With the advent of high-power lasers in recent decades, a unique source of hard X-ray radiation has become availible. This source of collimated, broadband, femtosecond, incoherent and hard X-ray radiation is produced when a focused laser with intensity above 10^18 W/cm^2 collides with a gas target. The strong electric field of the laser pulse ionizes the gas and interacts with the plasma generating a strong plasma wake wave. This space charge separation inside the target generates longitudal electric fields of the order of 100 GV/m. This resulting electrostatic wakefield accelerates the electrons to relativistic velocities and causes them to travel in oscillatory motion behind the laser pulse, producing hard and collimated X-ray radiation. This thesis is focused on a theoretical evaluation and an experimental design of this laser-plasma X-ray source. Furthermore, we consider the source's unique properties for novel imaging applications.