

the method of achieving that result, or the appropriate design of that result, is uncertain as of the beginning of the taxpayer's research activities. A process of experimentation must fundamentally rely on the principles of the physical or biological sciences, engineering, or computer science and involves the identification of uncertainty concerning the development or improvement of a business component, the identification of one or more alternatives intended to eliminate that uncertainty, and the identification and the conduct of a process of evaluating the alternatives (through, for example, modeling, simulation, or a systematic trial and error methodology). A process of experimentation must be an evaluative process and generally should be capable of evaluating more than one alternative. A taxpayer may undertake a process of experimentation if there is no uncertainty concerning the taxpayer's capability or method of achieving the desired result so long as the appropriate design of the desired result is uncertain as of the beginning of the taxpayer's research activities. Uncertainty concerning the development or improvement of the business component (*e.g.*, its appropriate design) does not establish that all activities undertaken to achieve that new or improved business component constitute a process of experimentation.

(ii) *Qualified purpose.* For purposes of section 41(d) and this section, a process of experimentation is undertaken for a qualified purpose if it relates to a new or improved function, performance, reliability or quality of the business component. Research will not be treated as conducted for a qualified purpose if it relates to style, taste, cosmetic, or seasonal design factors.

(6) *Substantially all requirement.* In order for activities to constitute qualified research under section 41(d)(1), substantially all of the activities must constitute elements of a process of experimentation that relates to a qualified purpose. The substantially all requirement of section 41(d)(1)(C) and paragraph (a)(2)(iii) of this section is satisfied only if 80 percent or more of a taxpayer's research activities, measured on a cost or other consistently applied reasonable basis (and without regard to section 1.41-2(d)(2)), constitute elements of a process of experimentation for a purpose described in section 41(d)(3). Accordingly, if 80 percent (or more) of a taxpayer's research activities with respect to a business component constitute elements of a process of experimentation for a purpose described in section 41(d)(3), the substantially all requirement is

satisfied even if the remaining 20 percent (or less) of a taxpayer's research activities with respect to the business component do not constitute elements of a process of experimentation for a purpose described in section 41(d)(3), so long as these remaining research activities satisfy the requirements of section 41(d)(1)(A) and are not otherwise excluded under section 41(d)(4). The substantially all requirement is applied separately to each business component.

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(8) *Illustrations.* The following examples illustrate the application of paragraph (a)(5) of this section:

*Example 1. (i) Facts.* X is engaged in the business of developing and manufacturing widgets. X wants to change the color of its blue widget to green. X obtains from various suppliers several different shades of green paint. X paints several sample widgets, and surveys X's customers to determine which shade of green X's customers prefer.

(ii) *Conclusion.* X's activities to change the color of its blue widget to green are not qualified research under section 41(d)(1) and paragraph (a)(5) of this section because substantially all of X's activities are not undertaken for a qualified purpose. All of X's research activities are related to style, taste, cosmetic, or seasonal design factors.

*Example 2. (i) Facts.* The facts are the same as in *Example 1*, except that X chooses one of the green paints. X obtains samples of the green paint from a supplier and determines that X must modify its painting process to accommodate the green paint because the green paint has different characteristics from other paints X has used. X obtains detailed data on the green paint from X's paint supplier. X also consults with the manufacturer of X's paint spraying machines. The manufacturer informs X that X must acquire a new nozzle that operates with the green paint X wants to use. X tests the nozzles to ensure that they work as specified by the manufacturer of the paint spraying machines.

(ii) *Conclusion.* X's activities to modify its painting process are a separate business component under section 41(d)(2)(A). X's activities to modify its painting process to change the color of its blue widget to green are not qualified research under section 41(d)(1) and paragraph (a)(5) of this section. X did not conduct a process of evaluating alternatives in order to eliminate uncertainty regarding the modification of its painting process. Rather, the manufacturer of the paint machines eliminated X's uncertainty regarding the modification of its painting process. X's activities to test the nozzles to determine if the nozzles work as specified by the manufacturer of the paint spraying machines are in the nature of routine or ordinary testing or inspection for quality control.

*Example 3. (i) Facts.* X is engaged in the business of manufacturing food products and currently manufactures a large-shred version of a product. X seeks to modify its current production line to permit it to manufacture

both a large-shred version and a fine-shred version of one of its food products. A smaller, thinner shredding blade capable of producing a fine-shred version of the food product, however, is not commercially available. Thus, X must develop a new shredding blade that can be fitted onto its current production line. X is uncertain concerning the design of the new shredding blade, because the material used in its existing blade breaks when machined into smaller, thinner blades. X engages in a systematic trial and error process of analyzing various blade designs and materials to determine whether the new shredding blade must be constructed of a different material from that of its existing shredding blade and, if so, what material will best meet X's functional requirements.

(ii) *Conclusion.* X's activities to modify its current production line by developing the new shredding blade meet the requirements of qualified research as set forth in paragraph (a)(2) of this section. Substantially all of X's activities constitute elements of a process of experimentation because X evaluated alternatives to achieve a result where the method of achieving that result, and the appropriate design of that result, were uncertain as of the beginning of the taxpayer's research activities. X identified uncertainties related to the development of a business component, and identified alternatives intended to eliminate these uncertainties. Furthermore, X's process of evaluating identified alternatives was technological in nature, and was undertaken to eliminate the uncertainties.

*Example 4. (i) Facts.* X is in the business of designing, developing and manufacturing automobiles. In response to government-mandated fuel economy requirements, X seeks to update its current model vehicle and undertakes to improve aerodynamics by lowering the hood of its current model vehicle. X determines, however, that lowering the hood changes the air flow under the hood, which changes the rate at which air enters the engine through the air intake system, and which reduces the functionality of the cooling system. X's engineers are uncertain how to design a lower hood to obtain the increased fuel economy, while maintaining the necessary air flow under the hood. X designs, models, simulates, tests, refines, and re-tests several alternative designs for the hood and associated proposed modifications to both the air intake system and cooling system. This process enables X to eliminate the uncertainties related to the integrated design of the hood, air intake system, and cooling system, and such activities constitute eighty-five percent of X's total activities to update its current model vehicle. X then engages in additional activities that do not involve a process of evaluating alternatives in order to eliminate uncertainties. The additional activities constitute only fifteen percent of X's total activities to update its current model vehicle.

(ii) *Conclusion.* In general, if eighty percent or more of a taxpayer's research activities measured on a cost or other consistently applied reasonable basis constitute elements of a process of experimentation for a qualified purpose under section 41(d)(3)(A) and paragraph (a)(5)(ii) of this section, then